SUPPLEMENT.

The Mining Journal,

[R]AILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

THE GOVAN FOUNDRY AND IRON WORKS.

[T]hose engaged in the iron trade the Govan brand will be known [as one] of the best in the market. Although it has been before the [public] for upwards of 30 years, no description of iron can at the [presen]t time command better quotations. A slight sketch, therefore, [of the] works of Mr. DIXON, better known as the Govan Iron Works, [may n]ot be uninteresting to our readers.

[Gov]an is a distinct parish from Glasgow, although it forms to all [intents] and purposes part of that city. The Govan Iron Works are [situat]ed on the outskirts of the parish of that name, and within ½ mile [of the] Clyde. They comprise a foundry and engineering establish[ment,] five blast-furnaces, plate-mills, 50 puddling-furnaces, and an [extens]ive coal depôt. The latter is in connection with Mr. DIXON'S [collie]ries at Carfin Clelland, Calder, Bishopsbriggs, Ibrox (Paisley), [...]ton, Aird's Moss, and Ernock Moor. From these numerous col[lieries] the fuel is principally supplied for the Govan and Calder Iron [Works,] both of which are owned by the same proprietors. Mr. DIXON'S [iron is] generally esteemed for its superior qualities, and hence it is [in gre]at demand. Taking the different departments in order, we [will c]ommence by noticing—

[TH]E BLAST-FURNACES.—Although three are five blast-furnaces [built] and ready for use in connection with the Govan Iron Works, [one of] them is always out, and kept ready for use while either of the [others] is undergoing alterations or repairs. A sixth furnace was some [time a]go commenced, and proceeded with to the height of 12 ft., but [owing to th]e state of the trade at that time, and the low quotations since ob[tained,] have been such as to induce Mr. DIXON not to carry it to com[pletion.] About 240 men are employed in the blast-furnace depart[ment.] The furnaces are blown by a high-pressure engine of 320-horse [power.] This engine, which is one of the largest in Scotland, was de[signed b]y JAMES WATT, and made in Hill-street, Glasgow, nearly [... years] ago. It is 11 ft. 3 in. stroke, and has two blowing cylinders, [... f]t. in diameter. A noteworthy feature is the walking-beam, [which is] 30 tons weight, 30 ft. in length, and has double pistons at [each sw]ing end. Each of the furnaces in blast turns out, when in [good worki]ng order, about 28 tons per day, and the daily consumption [of coal] for the whole four is about 170 tons, with 80 tons of dross in [addition.] All of the furnaces are carried to the uniform height of [...b]eing 45 ft. to the tunnel head, and 14 ft. above, while they are [... at t]he hearth. They possess several features which are not con[sistent wi]th the most recent improvements. For example, instead [of the o]rdinary and most economical mode of bringing the fuel to [the top, t]he coals are hoisted to the level of the tunnel head by means [of sm]all engine. One man has to fill the coals at the bottom of the [lift, an]other man receives them at the top, and a third man deposits [them] in the furnace. Blackband and clayband are the kinds of [ore] principally used, although, as is well known, the native [ore] will do for the better qualities of iron without an admixture [of th]e Spanish, Whitehaven, or Cleveland ores. The latter are [used] in proportion to the quantity of "pig" produced. No. 1 [pig, o]f 10 cwts. burden, usually contains about 2 cwts. Spanish ore, [... cw]ts. hematite, 3 cwts. blackband, and 2 to 3 cwts. lime. It [may be] interesting to mention that Mr. BESSEMER, who is known to [be] the inventor of a process than which none better has yet [been dis]covered for the manufacture of steel, carried on a long [series of] experiments at the Govan Iron Works some few years ago. [As a che]mist, Mr. BESSEMER long cherished the idea that ordinary [pig co]uld be made into malleable iron without going through the [puddling] process. He tried a great many experiments with black[band an]d clayband ironstone, in order to secure this result, but, of [course, t]he attempt was a failure, and Mr. BESSEMER had to stop [...] an ultimatum which, if it had been realised, would have [re]warded both he and Mr. DIXON—under whose auspices the [experim]ents were carried on—for their trouble and expense. There [are no] refineries in connection with this department, of the ordinary [...] description. At the Calder Iron Works (which we may have [occasion] to notice at some future time), Mr. DIXON has eight fur[naces, s]ix in and two out of blast.

[TH]E ROLLING-MILLS.—There is very little specially deserving [of remar]k about the mills and puddling-furnaces, although, perhaps, [they turn] out a larger quantity of bar iron—something like 20,000 [tons per] annum—than any similar establishment in Scotland. In [addition] to the 50 puddling-furnaces we have already mentioned, [there are] two merchant mills, two guide mills, and a plate-mill. [These] are undertaken for the manufacture of all the ordinary [bar,] beam, angle, and merchant iron. The mills are driven by [powe]rful engines—two horizontal and three beam. To avoid, [or at least] to mitigate, the nuisance which is inseparable from the proxi[mity of s]uch large works to a centre of population like Glasgow, an [arrangem]ent has been carried out which might be copied with ad[vantage] elsewhere. The smoke from the whole of the puddling-fur[naces pa]sses into three main culverts, and is thereby carried off by [a stack ...] about 140 ft. in height beyond the reach of molesting the [neighbourho]und about. Three of GORMAN'S patent puddling-furnaces [have bee]n introduced into this department, and are found to work [satis]factorily. These furnaces are most effective as smoke-con[sumers.] If the firing is done carelessly a little smoke will arise, but [t]here is nothing of the kind to be seen. GORMAN'S heat[ing] gas-furnace was first constructed at the Govan Bar-Iron [Works in] the year 1864. It had only been a short time in operation, [when] when the puddlers objected to its use, on the ground that [it di]d not work it so well as the kind to which they had pre[vious]een accustomed. The result of this opposition was that the [use] of furnace was re-introduced, and it was not until Feb[ruary] this year that the new furnace received a fair trial. The [result wa]s so satisfactory that three of the furnaces have been con[stantly in] use ever since, and another is in course of erection. The [difference] between the ordinary furnace and GORMAN'S [is] this—that in the ordinary furnace the cake, or solid part [of the coal], is completely burned on the grate, and in consequence the [gaseous p]art of the coal is lost, whereas in GORMAN'S furnace the [solid part] of the coal is converted into carbonic oxide gas, which is [...]ie, and along with the coal gas is burned with a further [supply of] air on the part of the furnace where the heat is wanted. [Thus the] heat from the gas, as well as from the solid part [of the coal], is obtained. This is almost the only new invention or improvement that has been introduced within recent years into the bar mills. There are about 500 men employed in this department, and although bar iron is principally made, rails, angle, and beam iron are turned out of the 16-in. mill.

THE FOUNDRY.—In the engineering department, all the work required by Mr. DIXON in connection with his iron works, collieries, and mines is done. The foundry is divided into three separate sections or parts—the moulding, the forging, and the erecting. The marine engines for the Government iron shipbuilding firms of JOHN ELDER and Co., and INGLIS and Co., are nearly all made at this establishment. A high-pressure beam-engine, 26 inches in diameter, is the only one used in connection with this part of the works. An order for a pumping-engine of 100-inch cylinder, and 13-feet stroke, is being executed at the present time in the moulding department, where there are two air-furnaces in operation. Two cupolas are also used, the motive-power being the cylinder, instead of the fan-blast, which has now become so general. It may be interesting to engineers to know that CONDIE'S steam-hammers were first made at these works, and orders for the construction of several large hammers of this kind are now on hand, one for the Lancefield Forge Company being 60 cwts. A 24-inch high-pressure steam-engine, for raising coal out of pits, is also in course of erection. CONDIE'S hammers are made either of single or double-action, giving the steam above or below the piston, as the case may be. A boring-engine is used for the heaviest class of work. In the forging department one of SIEMENS'S gas-furnaces may be seen in operation. This is one of the largest size of SIEMENS'S furnace, and it is used for all kinds of heavy forgings. It has been found to effect a saving in the consumption of fuel, and it does not cause the same percentage of waste in the iron as another furnace. One of CONDIE'S double-acting 56-cwt. steam-hammers is used in the forging-mill, as also a spoke-bending machine (by CRAIG and FULLARTON, of Paisley), which, of course, is used chiefly for railway work.

THE NEWPORT IRON WORKS, NEAR MIDDLESBOROUGH.

These works, carried on under the proprietorship of Messrs. B. Samuelson and Company, consist of seven blast-furnaces, with the requisite appliances, erected in two separate plants, all of which are in operation. Five of the blast-furnaces are at the older works, and two at the new works, recently completed, about 200 yards distant from the former. The extension and improvements which have so rapidly taken place in the Cleveland district in this branch of the iron trade make these relative terms applicable within a brief period. This firm is one of the largest producers of pig-iron in the Middlesborough district, and the works, as will be seen, possess many features which are of interest.

THE OLD FURNACES AND WORKS.—There are five blast-furnaces built in a line, with brick pillars, the upper portion enclosed in wrought-iron shells, and the front is to the north. The stoves are placed between and behind the furnaces. The lifts, gantry, kilns, and hopper are on the south side. No. 1 furnace was blown-in in July, 1864, Nos. 2, 3, and 4 afterwards, in the same year; the height of these is 70 ft., 20 ft. in the bosh, and 16,000 cubic feet in capacity. No. 5 furnace was blown-in in December, 1867; its height is 70 ft., and 21½ ft. in the bosh. The furnaces are all made close at the top, on the cup and cone method. Two furnace-lifts, on the water-balance principle, are placed behind the furnaces, and lift 78 ft., each having two carriages; one lift raises materials to two furnaces, the other to three. There are 15 air heating-stoves altogether, fitted with cast-iron pipes. Three stoves are appropriated to each furnace, one at each side and one at the back of it. Each stove has three rows of U-pipes, 16 in. by 5 in. in section; the two outer rows lean together at the top, the middle row is placed between. The row consists of four double pipes, in 18-ft. lengths, excepting at No. 5 furnace, where there are five in each row. Each stove is divided by a brick wall across the middle, by which either half may be used or disused, as required. The heated blast from each division unites through a breeches-pipe and valve-box into one pipe, and the whole stove supplies one tuyere. Each furnace has three tuyeres, working independently of one another. The heating surface in the pipes of one stove internally is 7500 square feet. A short brick chimney and damper are provided to each stove. The down pipe from each furnace is of wrought-iron, 6 ft. in diameter, not lined. These all communicate to the main underground gas culvert, which is 36 ft. in sectional area, slightly arched at top and bottom. It runs between the furnaces and stoves the whole length, from the west to the east end boilers. From the gas culvert a branch to each division of a stove is constructed of brickwork, by which the stoves are heated entirely with gas, and the boilers also, excepting under special circumstances.

The cold-blast main pipe is 4½ ft. in diameter; it runs close behind the furnaces, extending between the west and east end blowing-engines, and is open to each. From this main there are two wrought-iron branch pipes to a stove, being one branch to each division. The pressure of blast is 4 lbs. per inch. The temperature at the tuyeres is 1100°, according to Siemens' pyrometer; the pressure during the day is frequently tested by applying pure zinc to the blast at the tuyeres, which melts in six seconds at the above temperature. The average production of pig-iron from each furnace is about 280 tons per week of mixed qualities. The local Cleveland ore, with a slight mixture of others, is used for smelting, together with Durham coke and Weardale or Raisby-hill limestone. The consumption of coke throughout is 22½ cwts. per ton of pig-iron.

The limestone, foreign ore, and coke in part are stocked under a low gantry, running behind and parallel with the stoves, which is approached by a locomotive road. Behind this gantry a range of five calcining kilns and one 250-ton coke hopper are erected. The kilns are 40 ft. in height from the surface; four of them are 22 feet in diameter at the upper part, 11,000 cubic feet in capacity; the fifth is 28 ft. in diameter, and 16,000 cubic feet in capacity. The kiln sides are brought in towards the bottom, a cast-iron cone is fixed in the middle of each, and the delivery is on a base 3 ft. from the ground. A 42-ft. lift, including the girders at the top, raises the laden trucks by means of a steam-ram 32 in. in diameter, 42-ft. stroke, fixed in a well below the surface. The well is 8 ft. in diameter, lined with cast-iron cylinders. The steam is generated in an Adamson boiler, placed close to the lift, acting with a pressure of 80 lbs. per inch under the ram, which is afterwards ejected by the descent of the ram and carriage. The empty trucks are lowered at the opposite end of the range by a balance-drop.

In the west building four blowing-engines are erected, three being in operation. Three of these are on Slate's principle: the steam-cylinders at top, 35 in.; blowing-cylinders below, 78 in.; resting on cast-iron standards; stroke 4 ft.; two fly-wheels to each; they are now going 36 strokes per minute, but they can be driven at twice that speed. The engines have been in action six years, and are as effective still as at first, but there is a loss of power peculiar to them, from the way in which the air is compressed within the slide-jacket. The fourth blowing-engine is a condensing one, with steam-cylinder at top, 61¾ in.; blowing-cylinder below, 78 in. in diameter; these are supported on two standards; stroke 4 feet. The escape steam from the three Slate's engines is utilised in part by this engine, at 15 lbs. pressure. The steam is condensed by surface condensers placed outside the building; these consist of 10 annular pipes, 12 ft. in length, between which the steam enters for condensation. The outer pipes are 2 feet 6 inches in diameter. In the same building five pumping-engines are fixed, to supply the two furnace-lifts and the tank on the house with water. A part of these were made by Mr. John Cameron and part by Mr. M. Samuelson, at Hull, on Cameron's principle—double inverted cylinders, and two rams to each engine; they have 14-inch steam-cylinders, 12-inch rams, 16-inch stroke. Two more of Cameron's engines are fixed in the house, to feed the boilers, these have 8-in. steam-cylinders, 6-in. rams, 8-in. stroke. Eleven plain cylindrical boilers supply the 10 non-condensing engines with steam, at 60 lbs. pressure; nine of these are generally in use. Each boiler is 75 ft. by 4 ft. in diameter, rests on the seating by means of iron knees, and is covered with brickwork to retain its heat. The chimney for these boilers is 160 feet in height.

In the east engine-house one blowing-engine is erected, with room for another. This was made at John Stevenson's works, of Preston. The steam-cylinder is 32 in., blowing cylinder beneath 72 in., supported on hollow cast-iron standards, 4-ft. stroke. The blowing-cylinder is fitted with India-rubber valves. The steam is cut off at one-half stroke, and used expansively; the usual rate of going is 25 strokes per minute. The engine draws its air partly from the outside of the building. This engine stands 25 ft. in height from the foundation; the foundation consists of beams of timber, laid on brickwork. In the same house two of Cameron's pumping-engines are erected, with 6-in. steam cylinders, 4-in. rams, 6-in. stroke; one or both of these feed the boilers. Four Cornish boilers are used to generate steam for these three engines, 35 by 5½ ft. in shell, 2 ft. 9 in. in flue, each suspended from two arched girders, and covered with Jones's non-conducting composition, in squares. The chimney for these boilers is 120 feet in height.

THE NEW FURNACE PLANT.—The two new blast-furnaces are 70 ft. apart from their centres, 85 ft. in height, 28 ft. in the bosh, 8 ft. at the hearth; each has a capacity of 32,000 cubic feet. The whole of the new plant was built in thirteen months, and smelting operations were commenced in May, 1870. The body of each furnace is supported on twelve cast-iron columns and a broad cap, and cased with wrought-iron plates from 7-16 in. to ⅝ in. in thickness. The breast-work is also plated with iron of greater strength. Several improvements have been introduced in the general arrangement of the plant, under the direction of Mr. R. Howson, the engineer of the works, as well as in the blowing-engines, and the Cornish type of boiler has been adopted in preference to the long plain boilers. The front of these furnaces is to the south. The stoves and kilns are arranged in two separate lines, on the back or north side of the furnaces. The lift for the furnaces is placed between them, and raises 92 ft., with a steam-engine placed at an elevation of 100 ft. The landing platform, with the engine above it, are supported from the summit of the furnaces on three wrought-iron girders, having three intermediate cast-iron columns as supports, which also serve as guides to the two carriages in their ascent and descent. The engine has two 8-in. vertical cylinders, 12-in. stroke. It was designed to make the lift of 92 ft. in one minute, with 100 revolutions, on the third motion. The first pair of wheels have 22 and 87 teeth, the second pair 18 and 168 teeth respectively. The two rope-pulleys are 12 ft. in diameter, one on each side of the last-named spur-wheel. Two 3½-in. steel wire-ropes are attached to each carriage, which pass half round the pulleys. The breaking strain of each rope is 36 tons; the working strain, 5·4 tons, or for two ropes 10·8 tons; but the greatest weight that will be brought to bear on two ropes is 5 tons. The steam for this engine is taken from the boilers by 200 ft. of covered pipes.

Nine stoves, with cast-iron pipes, are appropriated to each furnace, placed close behind the furnace in one block, with a wrought-iron chimney and damper to each. The pipes in each stove are in two rows of six double pipes 16 ft. 4 in. in length, leaning so as to join at the top; these furnish an internal heating surface of 10,000 square feet in one stove. The blast passes completely through one row of pipes, entering from thence the valve-box, and into the hot-blast main in front, which is common to the whole of the stoves for one furnace; the hot-blast main is 4 ft. 4 in. in diameter, lined with 14-in. brickwork, giving an internal diameter of 2 ft. The cold-blast main at the back of the stoves is 4 ft. in diameter, having a branch from it to each stove. The iron down pipe from each furnace is 6½ ft. in diameter, not lined, and both discharge into the underground gas culvert, which is made under the space between the furnaces and stoves, and extends also to the boilers. The gas culvert is 6 ft. 4 in. in height by 5½ ft., arched at the top and bottom; a cast-iron pipe with valve branches from it to each stove and boiler. This arrangement affords a high temperature of blast—1200° at the tuyeres; the pressure of blast is 4½ lbs. per inch. Four tuyeres are blown in each furnace; the pipes to these branch off at equi-distant points from the horse-shoe main, also lined with fire-brick. The make at each furnace is at present 450 tons of pig-iron per week, on a consumption of 19 cwts. of coke per ton of iron, principally of the higher qualities. The tuyere pipes now used are 5½ in. at the muzzle, but larger pipes will shortly be used, which will tend to increase the make of iron. Owing to the large quantity of slag produced from each furnace it is found necessary to have double slag boxes, one in front of another, with communication, so that the slag will fill them simultaneously. Four roads suffice for this arrangement, whereas with single boxes eight roads would be required. Five calcining kilns, two 250-ton coke-hoppers, and one coal-hopper are erected in a range behind the stoves. Each kiln is 35 ft. internal height, base of 3 ft.; girder, 2 ft., equal 40 ft. from the surface to the rails; diameter at top, 26 ft.; capacity, 15,800 ft. Ironstone and limestone are calcined together in these kilns. A steam-lift has been adopted for this range of kilns and hoppers; the steam-cylinder is 38 in. in diameter, 40-ft. stroke, is elevated vertically above the level of the upper rails, and supported

on a strong framework of cast-iron columns and tie-beams. The cylinder is enclosed by another of wrought-iron, 9 ft. in diameter. Two balance weights assist in raising the laden trucks; one laden truck with the cage weighs 21 tons; the cage in descending raises the balance weights. At the opposite end of the kilns the empty trucks are lowered by a balance-drop.

Four blowing-engines erected in one building, and made at J. Stevenson's works, have each 32-inch steam cylinder, 66-inch blowing-cylinder beneath, 4-feet stroke, steam pressure 55 lbs. Two engines are coupled together, and work one fly-wheel, but either of these may be worked independently; the two engines are placed at right angles to each other with respect to the cranks, affording greater facility in turning the centres. These engines are fitted with expansion valves, and now work with steam cut off at one-fourth of the stroke; the expansion can be varied as required. The rate of going at present is 24 strokes per minute, but double this speed can easily be attained. In the same building two of Cameron's pumping-engines supply the tank on the top of it; these have 10-inch steam cylinders, 8-inch rams, 10-inch stroke. Also two engines of the same kind to feed the boilers; these have 8-inch cylinders, 6-inch rams, and 8-inch stroke. Eight Cornish boilers supply the above-named engines, each boiler is 35 feet by 5¼ feet in the shell; tube 2 feet 9 inches in diameter; these are also covered with the non-conducting composition. The chimney is 110 feet in height. The feed water for these and all the other boilers is heated to 100° previous to its being supplied to them.

SCOTCH PIG-IRON—WARRANT STORES.

SIR,—The correspondent in the Supplement to the Journal of Oct. 8 states most forcibly the reasons for requiring in the storing of pig-iron those elements of security and order, the want of which would not for a moment be tolerated in regard to the storage of other articles of produce or manufacture. He candidly and fully acknowledges the soundness of the principle on which one of the pig-iron stores in Glasgow is conducted, but desiderates a nearer approach to perfection. He then proceeds to explain the causes which operate against the store conducted on the system which "has so far the unqualified approval of the trade."

Your correspondent will excuse me if I say that I consider his reasons far from conclusive. The Canal store is, no doubt, restricted to one locality, but iron is as cheaply (to the warrant holder) delivered from it to any point of the city as from the other stores; and, indeed, in some instances, is delivered at points not included in the other's list. Again, the Canal store offers equal facilities for storing or delivering daily, and the proximity of the store to the point of delivery does not in either case abate one farthing of the charge. The arrangements for issuing warrants are, if anything, superior in the way of preventing detention, seeing the Warrant Office is nearer to the Royal Exchange, where the iron merchants and brokers meet. No doubt the position of the Canal store is more accessible to the ironmaster of the Coatbridge district than to his brother of Ayrshire, who would be put to the additional expense of taking up the iron from the railway stations from the south side of the Clyde. But even here, when iron is sold in Glasgow the price includes delivery within Glasgow; whether that be further from, or nearer to, the railway station, and the extra expense would fall not on the warrant-holder, but on the ironmaster.

It seems to me that your ordinary correspondent hits the right nail on the head, when he remarks, in his report in the Journal, that the matter is entirely in the hands of those storing pig-iron. I presume he means by this the *holders of warrants*, for it may readily happen that the party who puts iron in store, for the mere purpose of selling his warrant, is not the best judge of the security afforded to his customer, who may hold it for years. CREDO.

RATING OF MINES AND COLLIERIES.

SIR,—I see, by the Supplements to the *Mining Journal* of Oct. 1 and 8, that the colliery proprietors in South Wales are raising the question of rating their respective collieries, and propose an appeal to the Quarter Sessions, considering that 6d. per ton is not an equalisation among them all. Taking into consideration the words in the Act of Elizabeth that the rates shall be equal, and that the rent shall be the basis of such rates—*Query*, what is rent as respects a colliery more than a house, shop, or farm in the eye of the law?—they are, or should be, equal; therefore, the *bona fide* rent is to be the thing sought for, and how is that to be found?—only by a reference to the lease or agreement entered into between the landlord and the tenant; for, if I am not mistaken, the lease specifies that "a rent or royalty shall be paid," &c. With that view I have embodied my sentiments in a letter to the Secretary of State on the recent Bills which have been brought into Parliament on the Assessment of Metalliferous Mines in 1867, which should also apply to collieries.

CLAUSE 1.—"From and after Oct. 1" to be altered to "Dec. 31," and the following words to be added in line 14, after the words "local rates," "to be brought into assessment on March 26," for the following reason—on March 25 in every year the new owners come into office. They or their assistants would call at the respective mines or collieries, or upon the lords or their agents, where they would ascertain the true amount due or paid in royalty, rent, or toll during the previous year, ending Dec. 31. The above dates will give these mining or colliery companies or lords' agents time to alter their books in case they now make up their royalty accounts at any other period of the year than Dec. 31."

CLAUSE 2.—To strike out the following words (which are only handles for law suits) "until the contrary be shown, be deemed to be." The clause will then be intelligible, and stand thus—"In the case of a mine or colliery the royalty or rent reserved or payable to the owner *shall be* the gross estimated value of such mine or colliery."

CLAUSE 3.—To alter the whole of this clause, as follows:—"Provided always, that in calculating the annual rateable value of a mine or colliery a deduction of (say) — per cent. shall be made to reduce the gross estimated to the rateable value. This deduction to inclue all allowances for wear and tear, the usual tenant's rates and taxes, tithe commutation rent charge (if any), and the probable average cost of repairs, insurances, and other expenses (if any) necessary to maintain it so as to command such rent, and the exhaustion of the mineral represented by accumulation of its original fee-simple value, and the value of the capital expended thereon.

CLAUSE 4 to be entirely struck out, for the following reason—the expenses attending the working of mines and collieries by companies are, in many instances, great; and, by so doing, they develope the resources of a property belonging to a person who would not do it himself, but who often receives a large income in rent or royalty from their outlay, without contributing one shilling towards the losses or accidents happening there; it, therefore, becomes a hardship on those companies, many of whom are struggling hard for existence, to be compelled to contribute even a moiety of the rates.

CLAUSE 5 would then stand thus—"Provided always, that after the passing of the Act no occupier of any mine or colliery in England or Wales shall be rated to the relief of the poor, to the county, or highways, and the other local rates; and no assessment shall be made on such mines, otherwise than on the owner or owners, in respect of the rent, royalty, toll, or due reserved to him or them."

CLAUSE 6 is wholly incomprehensible—for instance, a mine occupies or requires about 5 acres of land, at an agricultural value of (say) 20s. an acre. Is this large mine to be rated under the Local Government Act at only 5*l.* gross estimated value, while, at the same time, rated at 1000*l.* to the local poor rates? Therefore, this clause should be struck out, or properly amended.

CLAUSE 7.—An interpretation clause, altogether omitted in the Bill—"Provided always, that the word 'owner' shall mean the owner of the minerals. The word 'mine' shall include buildings of every description on the mine, including the general plant, such as shafts, engine-houses, smithies, saw-pits, sheds and offices, and the land *bona fide* used for mining purposes; also ponds and water-leats conveying water for the use of the mine (except houses occupied as residences by the miners, or mine captains, or overlookers on or adjoining the mines; also the whole of the underground workings, whether they cross the boundaries from one parish or township into another, and shall be rated in that parish or township where the winding-shaft is situate, or until another winding-shaft is sunk and available in the adjoining parish or township, when that part of the mine shall be a distinct mine, and rated accordingly."

I throw out these suggestions now in hopes that they will be duly considered, and lead to a discussion in your valuable journal, as I am impressed with the idea that if adopted litigation will cease, as by throwing all the rates on the landlord the colliery proprietors will then have *only one rent to pay*, and greater cordiality will prevail between them and their brother parishioners. J. G. WILLIAMS.

Glanavon, Pwllheli.

RATING TO THE POOR.

SIR,—In the *Advertiser* published in this town last Saturday I read a copy of a letter taken from the *Mining Journal* of the previous week, which savoured too strongly of facts to be contradicted in any material point. The opinion here is that the important question has at last got into the right groove for ventilation, and that a sound honest decree will be placed before the public, and, in particular, Mr. Goschen, to whom we look for legislation on this all-important subject of dispute. The letter published by "Reader," to which I have referred, is rather contractory. Why did "Reader" confine himself to mines, damaged land, &c.? The rating question is one of the greatest importance. It is said that one of the towns in our Union is rated so low that first-class shops and houses are rated at little more than cottages, and that those who understand the question of rating residing amongst them tremble at the idea of a new assessment; but while this is the case with the rich and the well-to-do, the poor cottager and the ill-to-do are rated up to the hilt—the rating dagger has been driven to the inmost artery of the poor, to bleed them to the last drop. We hope Mr. Goschen's New Valuation Bill will right all this—if so, the honoured gentleman will merit the nation's warmest gratitude. I believe the attention of our Government has been called to funded property paying no rates; nor does railway rolling-stock. A friend has 100 trucks he rents at — per week; he pays no poor rate or any other rate. The same gentleman lets his shooting at a very large rent, but the assessor knows nothing of this rent, and the rent the farmer pays alone is considered in the assessment. Fishing is also let at 100*l.* per annum; this pays no poor rate.

I am interested in canals, and we are rated; but there are parties who own large quantities of boats, yielding a great revenue (let by the year to traders), which pay no poor rate. The writer thinks that every property which yields profit, either let, or worked, or used by the owner, ought to contribute its fair quota towards the maintenance of our institutions and the poor. I think it too bad for "Reader" to confine himself to the rating of our mines and damaged land. If the problem is at all to be solved by legislation, we ask for it to be extended to every property. The writer agrees with "Reader" that much wordy warfare has taken place, but be it remembered that iron works and mines are not the only properties which have gone on without paying rates, and when we are looked up I trust enquiry will be extended with a just balance. MINING MAN.

Brierley-hill, Staffordshire.

PREVENTION OF COLLIERY ACCIDENTS—No. VI.

SIR,—In carrying out my subject the next portion brings me to the consideration of the best mode of conveying minerals from the workings to the pit bottom.

In the early days of coal mining it was the habit to either carry the coal in baskets, wheel it in barrows, or draw it on sledges, the slippery nature of the floor much facilitating the latter method. When these primitive means were used the coal was not, of course, worked far from the shafts, or the labour would have been so great as to have rendered the working too expensive. The first step in advance was the introduction of wood rails, upon which wagons were run, and were first used in England at the Newcastle collieries. These wagons were made to carry several of the corves, which were drawn out of the workings and placed upon them by a crane, and then drawn by horses to the pit bottom. The corve is a wicker basket, having attached to it an iron bow, by which it is raised. The wood rails were superseded by cast-iron ones, and finally by those of wrought-iron. It was to within a very short time back the habit in some districts to bring the coal in small wagons to the shaft, and there tip them into a large iron receptacle, which was raised to the surface, and there again unloaded. Another plan, and one which is now even greatly used in the South Staffordshire and East Worcestershire districts, was to load the coal and bring it to the surface in skips. This plan is, for reasons I have before stated, much advocated by some of the old-fashioned colliery proprietors. The skip is a square wooden frame, fixed on wheels, having attached to it a large wrought-iron bow, which projects about 5 ft. from the wood frame. Round hoops, made of thin wrought-iron, are placed over the iron bow, and into these the coal is loaded; one hoop is placed over the other until the coal is piled to nearly the height of the top of the bow. Lashing chains are run through rings at the corners of the wood frame, and brought up to the hook of the winding-chain or rope, for additional security. Some of these skips are made to carry 30 cwts. of coal.

With the thorough adoption of cast and wrought iron rails came the now generally used tubs, and also cages and conductors. These tubs are in most cases made of wood, and are rectangular-shaped boxes, placed on two pairs of wheels. They have to be well bound with iron, or the coal would soon knock them to pieces. The best construction for a tub is, after a good sound wood box is made it should have two wrought-iron bars fitted to one side passed under the bottom up the other side, another similar bar should go lengthways of the tub, and fit against the ends; the whole of these bars should terminate in a square hoop of wrought-iron, binding the top of the tub. The wood is fastened to the iron by means of small nuts and bolts, and iron eyes are forged to the bend at the bottom of the bar, which runs longitudinally, through which the hooks are placed to draw the tubs. The advantages to be gained by using the tubs are that you can take them right up to the face of work to be loaded, draw them clear away to the shaft, and run them without hardly any trouble on to the deck of the cage, then raise them to the surface, draw them off the cage on to the rails, and take them to the unloading place, wherever that may be.

I would here say a few words in reference to the way the unloading and re-loading is done at many collieries, especially in the Centre of England. The rails, upon which the tubs run at the place where they are tipped, are raised 2 or 3 ft. above the floor upon which the coal is to be deposited; the tubs necessarily have to be pitched over with a lever, or otherwise, so as to discharge the load of coal, which has to be again taken up by the loaders and put into the carts or railway trucks. This way of working very soon knocks the tubs to pieces. The system carried on in Belgium, and at some places in this country, such as the Ruabon Coal Company's Hafod Deep Pits, Ruabon, North Wales, is far superior to that I have mentioned in many ways. The pit-frames, or head-stocks, are built very high, and the landing is done on a top floor, in which there are several holes, fitted with tipping apparatus, so that the tub has merely to be pushed from the pit top on to one of these holes, where it tips out the coal, rights itself, and runs back. The railway wagons stand under these holes and receive the coal, and where it needs sorting two floors are made, so that when the coal is tipped through the hole it falls on to screens, which conduct it down to the next floor, where it is picked and sent through other holes into the railway wagons. This last system saves a vast amount of wear and tear, and also labour, as it dispenses with several men and horses. In Belgium wrought-iron tubs are used, and found very servicable. As for the means for bringing the tubs from the workings to the shaft, it all depends upon the nature of the roads and lay of the mine. Horses are generally used where the roads are level, but should they incline either from or to the shaft other means have to be resorted to. Should the incline be from the workings to the shaft the loaded tubs are made to draw the empty ones up. This is done by means of a chain, or wire-rope, passing round a drum. The loaded tubs are fastened to one end of the chain at the top, and the empty ones to the other end at the bottom. The loaded tubs are then started down the incline, and they by their extra weight draw the empty ones to the top. A brake is attached to the drum to check the progress of the tubs, should they be going too fast. Three lines of rails are laid on these inclines, so that the middle line is used by both ascending and descending tubs. At the centre, where these pass, the road is made double, so that the tubs may not come in collision. Stalls, or holes, should be provided at short intervals in the sides of the road, so that men may escape into them should they be on the incline when the tubs are ascending or descending. The incline should also be furnished with proper signal wires, and with wood or iron pullies for the rope, or chain, to run upon, to prevent its being cut and worn by friction on the rough floor. In cases where the mine dips, or inclines, from the shaft it is necessary that steam-power should be employed to draw the tubs of coal from the workings. In some instances the engines are placed at the pit bottom, and others at the surface, on the pit bank, the winding-engines, in many cases, serving to draw the mine out of "the deep," as well as raise it in the shaft. These inclines are laid out in many respects similar to the self-acting ones, and have ropes, or chains, and friction pullies the same. The rails are laid in the same way, but they would be much better were double roads made right through. Wire-ropes are far preferable to chains, as they work with much less noise and friction. When the engine for drawing out of "the deep" is on the pit bank, the chain, or rope, is conducted down the side of the shaft, and works over elbow-pullies at the top and bottom. It is not a very safe plan to carry these chains down the sides of the shafts, as it is possible for them to come in contact with the ascending or descending cage, or they may break, and fall on the cage. It would, in my opinion, be a far more economical plan to use steam-power in preference to horses, even where the roads are level; and the work could be carried out with far greater expedition.

I intended that this letter should have been the last of the series, but I find it impossible to condense the whole of the matter within it. I will, therefore, leave the subject of ventilation for a concluding one, and now give a few remarks on safety-lamps. Preparatory to the invention of the Davy lamp, it was the practice to test the presence of gas by means of a candle, but this could only be done by a very expert collier, and was extremely dangerous. The Davy lamp is too well known to need description, and its adoption has saved the lives of thousands of colliers. The Davy, or in fact almost any of the lamps in use, is not safe under certain circumstances—for instance, in a draught, or rapid current of air, the flame is apt to be forced through the meshes of the gauze, and to ignite the treacherous carburetted hydrogen outside; it is also dangerous should the fire-damp burn inside it until the gauze becomes red-hot, and must be put out. There have been many improvements since the introduction of the Davy, but space will only permit me noticing a few of them. The Mueseler, or British lamp, as it is called in the Centre of England, is almost generally used in Belgium, and is a very simple and good one. It consists of a wire gauze top and a glass bottom; in the centre of the lamp a metal tube is fixed, and the heated air ascending this tube draws the cold air down through the gauze into the glass bottom, and feeds the flame. In this way a very perfect combustion is secured, and a superior light thrown out. The glass bottom is fitted in to brass expansion rings, which give with the glass when it is heated, and prevent its breaking the downward current of cold air; also keeps the glass cooler than in other lamps, and prevents much expansion. An advantage that this lamp has over the Davy is that it is not liable to be blown out by the draught, and it also extinguishes itself upon the air becoming explosive. This lamp gives less temptation to be opened for increase of light, as is the case with many others, for its illuminating power is very strong. There have been several inventions to prevent men opening their lamps to get lights for their pipes or other purposes, and these have principally had spring extinguishers, which as soon as the lamp is tampered with put out the light, but these, as a rule, have been found too complicated. The greatest invention since the Davy lamp is acknowledged by all great authorities to be Hyde's Patent Miners' Gas Alarm Lamp, a full description of which I will give in my next letter.

Dudley, Oct. 18. COLLIERY ENGINEER.

WHEAL, HUEL, OR MINE?

SIR,—In a late edition of your excellent little work the "Mining Glossary" I see an elaborate exposition on the meaning and derivation of the word "Wheal," so often prefixed to the name of a Cornish mine. It winds up by asserting that it means "mine." But on several occasions, when in the society of some of the best educated Cornishmen, I have heard it said that, according to *tradition*, "wheal" is simply a corruption of *wheel*, and formerly, during the piping times of Cornish flannel manufacture, applied to "tucking-mills," places near streams and rivers, where by means of a water-wheel and appropriate stamps flannel was shrunk to the desired solidity.

If this version be correct, then it follows that it is an error to suppose that "wheal" means "mine," and that it would be inadmissible to write, for instance, Wheal Van Tin Mine, which, by the way, I admit is never done, but would be correct enough if wheal is merely a corruption of *wheel*. Either the Cornish tradition, adopting the latter definition, or the learned derivation of wheal (huel) from the German, Saxon, Sanscrit, &c., and translated as "mine," is incorrect, and it would be interesting to learn to which side your readers incline, and what evidence they can quote in support of either theory.

ETYMOLOGIST.

THE METALS AND THEIR ORES—No. XIV.—GOLD.

SIR,—In Article No. XIII. I referred to the discoveries of gold known of by the ancients; in the present paper I purpose tracing the sources of the precious metal to more modern times.

Commencing with Great Britain, we find that in Cornwall prills of gold have from time immemorial been found associated with tin in the stream works. In Devonshire, in the early part of the fourteenth century, gold washings were conducted on an extensive scale at Combmartin, a large number of Derbyshire miners having been sent there for the purpose. In Newlands, Cumberland, gold likewise occurs; also in the counties of Lanark, Dumfries, and Perth. From the lead hills of Scotland, in the reign of James V., 300,000*l.* worth of gold was raised, and 300 labourers, engaged at 4d. per day, were employed at these diggings. In various portions both of North and South Wales gold has long been searched after, and the possession of the golden war chariots by the Ancient Britons, asserted to have been fabricated from the gold of their mines, certainly indicates that large stores of the precious metal must have been commanded by them in former times. Doubtless, the glitter of the golden cars, drawn by prancing and gaily-caparisoned steeds through the charming vales of the Principality, would have a magnificent effect, and it is not surprising that the conquest of a territory so well stored with golden treasures should have been eagerly struggled for by an invading foe. The Welsh gold mines of the present day are chiefly confined to Merionethshire, and in the neighbourhood of Dolgelly the quartz veins of the locality are extensively, and, in some measure successfully, worked for gold. In Ireland a famous discovery of this metal was made in 1796 upon the Ballina valley stream, Wicklow. The discovery is attributed to an Irish schoolmaster, who, being a lover of the art piscatorial, was in the habit of frequenting the brooks of the district. He appears, however, to have most successfully combined gold washing with fishing, and to the envy of his neighbours he gradually became rich. His secret, for a time well kept, at length became known—a rush to the place was made, all other pursuits were abandoned, and in about two months the peasantry collected and disposed of gold to the value of 10,000*l.* The Government subsequently took possession of the diggings, but the yield after a time fell off, and the works eventually became too poor to be profitably prosecuted. Hitherto the experience of modern British gold mining has mainly pointed but to one fact, and that has been the extreme uncertainty and irregularity in yield of the metal.

On the Continent very important districts are met with south of the Carpathian Mountains, at Kremnitz, Schemnitz, and Nagy-Banya, in Hungary, and ar Kapnik, Offenbanya, and Vorospatak, in Transylvania—the mines of the latter district having been regularly worked from the time of the Romans. The annual yield of the Hungarian mines is estimated at about 200,000*l.* sterling in value. In Sweden gold is found at Edelfors, and in Norway at Kongsberg. The gold mines of Galicia, Asturias, Andalusia, and Estramadura were formerly very productive, but of late Spanish gold mining has been

glected. The sands of the Rivers Rhine, Rhone, Danube, Reuss, Aar, and Moldau also produce gold. The Van Anzasca, near Piedmont, at the foot of the Alps, and the Hartz Mountains produce auriferous pyrites. Russia produces very large quantities of gold, and the Siberian mines of Catherinburg, on the east side of the Uralian Mountains, and those of Beresoff, Nershinsk, and Kolyvan, besides others on the Altai Mountains, have long been celebrated for their richness, the gold being found abundantly in the alluvial deposits (generally those which are most ferruginous), and also in quartz veins traversing the rock. Sir R. Murchison some years ago estimated the total production of Russian gold at three millions sterling. The gold of Africa, found chiefly in the form of gold dust, is produced from the sands of the Niger, Gambia, and other rivers, also from the Mozambique and more northerly portions of the East Coast, from regions in Central Africa, west of Abyssinia, and from the Gold Coast of Guinea, in Western Africa.

Other gold-producing countries of the world will be mentioned in my next paper to the Journal. EDWARD GLEDHILL.

Mining Offices, Shrewsbury, Oct. 17.

DESTRUCTIVE FIRE NEAR GRASS VALLEY.

SIR,—One of the most disastrous fires ever known since the annals of mining in California took place here on Sept. 20, by which all the machinery on the EMPIRE MINE became a total wreck. Beginning first at the mill, it spread with astonishing rapidity, consuming everything situated within 300 square yards, consisting of one pumping-engine, one hoisting-engine, powder-magazine, office, and store-room, stable, and 2000 cords of wood. Some five years ago the mill-house was designed and constructed under the superintendence of one Capt. Lee, who for many years followed the occupation of captain aboard one of the many steamboats which run up and down the Mississippi River, and somewhat after the fashion of these boats he erected this massive and expensive building, covering the whole structure with a coat of white paint, not forgetting to place quite a number of windows, so that the operators within should receive sufficient light. In this house was placed a splendid engine, with a fly-wheel weighing some 8 or 10 tons, and connected thereunto was a rock-breaker, 30-stamp mill, with every modern invention for the saving of gold; and so perfect was everything put in its place, that the engine, when put in motion, performed its duty with the regularity of clockwork. Thus was completed one of the finest mills in the State of California, at a cost of $100,000, and now a heap of ruins. On the day in question, about 3 o'clock in the afternoon, fire about the size of a man's hand was discovered high up the building, near the smoke-stack, when every available means in order to stay its progress was immediately put in practice, but without the least success. The fire spread with lightning swiftness, and in less than an hour the cord-wood, the hoisting and pumping works, the magazine, the office and store-room, and the stable, were in a furious blaze. When the magazine, which contained 190 kegs of powder, exploded the sight was magnificent. A stream of fire run into the black smoke from the burning pine wood, and the red flame turned into a white smoke, which soon surmounted the black column, and spread out several hundred feet in the air, something in comparison like a great white rose, having a huge black stem. When the shades of evening closed over this dreadful conflagration it left both earth and sky illuminated for several miles round, and the sight from the adjacent hills was remarkably grand. I visited the mine the day after the fire, in order, if possible, to ascertain the amount of damage, and such a havoc as met my eye I never shall forget. The place where once stood the splendid mill is marked only by smouldering embers and a mass of useless cast and wrought iron, lying promiscuously in a heap of ruins. The engine, I presume, kept working until the main strap burnt in two, when the velocity of the engine became so great that the fly-wheel flew to pieces, and one of the segments was found some 200 yards from the engine-room. The hoisting and pumping works are in the same predicament, nothing but a worthless heap of ruins, with the main shaft damaged to the depth of 50 ft. In the store-room there was a considerable quantity of quicksilver and candles, which were destroyed. The quicksilver tanks were found blown off at the upper end. The office, with all its contents, is completely destroyed. The books found in the safe are badly burnt, and for the most part are illegible.

The property is insured for $40,000. The mine has been paying well of late, and it is hoped that the damages will be rapidly repaired. But to do this, and put the mine in the same position as it was before the unfortunate accident happened, it will require an expenditure of $200,000. Whether the company are prepared to make such sacrifice and repair the damages remains as yet to be known.

Our mines in general are looking well, and within the past three months many of them have greatly improved. THOMAS FAULL.

Grass Valley Consolidated Mine, Sept 26.

A PROGRESSIVE MINE—GREAT ROYALTON.

SIR,—It is astonishing the amount of difficulty there is in the mining world to light upon a sound, progressive mine; but I think it is mainly that of choice. The number of prospectuses I have had sent me by disinterested individuals would, piled together, make a respectable pyramid, and my mind is still confused with the names of "Wheal Bangs," and so-called "Consols." Having by chance a few days at my disposal, I determined to visit personally a mining county. I chose Cornwall in preference to Wales, the mines in the Principality being, as a rule, more expensive to invest in, while the splendid price of tin must for a long time give the priority to the latter. I saw, of course, a great number of mines, mostly, if not all, progressive; and while one or two scarcely came up to my expectations, I think, on the whole, most of them are mines of great promise. I am alluding now chiefly to those to be found between Bodmin and St. Austell. A mine—Great Royalton—that is but seldom heard of, but must shortly take its place among the dividend-paying mines, I was greatly pleased with, the courteous manager of which—Capt. Parkyn—was good enough to show me over the sett, and he gave me several valuable particulars concerning the adventure. I saw the King's lode, which is going down richer and richer, and must at present be worth 80*l.* per fathom. The well-being of the mine, however, does not rest alone on that lode; there are several others of great promise. There seems to be, in addition to this, a prodigious amount of ore at surface, some of which I saw crushed by the 16 heads of stamps, other 16 heads being nearly completed. The engine-house seemed to be a massive structure, worthy of the machinery it encloses. I was quite surprised to hear there were only 4096 shares, with 18*s.* paid; they must indeed be cheap for the work performed and the future prospects, for it is a mine that promises to last for ages. On the whole, I cannot but think the shareholders are to be congratulated on their prospects, comparing it with many adventures now in the market.

Oct. 19. D. N.

NANTEOS CONSOLS.

SIR,—Kindly allow a few brief lines to appear in your next publication. Capt. Absalom Francis, in his letter on the above mine, in last week's Journal, states as follows:—"Having received circulars and reports of the mine, allow me to express an opinion that not even the sender of them, nor one out of twenty of the shareholders, are at all enlightened on the prospects of the property by their perusal." I have no desire, Mr. Editor, to raise the standard of quarrel. I am peaceful, and know, and am known to, Capt. A. Francis, and am, consequently, the more surprised at the remark that none of the shareholders, or, in other words, not one in twenty, nor the sender of the reports, knew the prospects of the property. I believe the agents who inspected this fine run of mines were chosen by the entire request of the board of directors, and whose reports I believe will appear in this week's Journal, when the public will be able to form an opinion of the capabilities of these two engineers.

Another remark, I believe, these engineers would flatly deny, which is embodied in the same letter of Capt. A. Francis—that for the sum of 300*l.* he could place the property in a state of lasting profits. And for the sake of justice to Mr. T. P. Thomas, whom I have known as an enterprising man, deeply interested in mines in Cardiganshire, and much respected by those who have had dealings with him, that for more than twenty years mining has been his study. And at times his pocket has severely felt the consequence; but I may add Bronfloyd, now the best, or equal to the best, in the Aberystwith district, was once the property of the individual who is thus publicly exposed as knowing no more of mining than a farmer. Twenty years' experience should teach a sensible man the way to farm a 1000 acres in the Midland Counties. Besides, Bronfloyd, South Darren, and other good mines were once the property of Mr. T. P. Thomas, showing that even twenty years ago he had an eye to mining. JUSTICE.

Aberystwith, Oct. 20.

MINING IN SOUTH WALES.

SIR,—I perceive Mr. Henry Gibson, some years since of 17, Gracechurch-street, has again entered the field for mining; he claims to be one of the first to pioneer mining in South Wales when the railway was no farther than Swansea. Early in 1852 he started Cassara, or, as he called it, the Great Welsh, and where he erected a 38-in. cylinder-engine—the first in that part of the kingdom; and the account of his proceedings at Llandovery, as recorded in the *Carmarthen Journal* for Sept. 12, 1854, must have been very satisfactory; and how far his predictions have proved correct can at once be ascertained by a visit to the district, and especially to the properties of those noblemen and gentlemen with whom he co-operated. At Rhydtalog he erected a substantial iron water-wheel, and the enterprise was in a fair way of getting to work, when his absence from England became necessary, in consequence of his vast mercantile operations. During his four years' wanderings in various parts of the world the mine was abandoned, but has lately been re-started, with a capital of 12,000*l.*, and should the company succeed it will be a further proof of Mr. Gibson's competence. He also claims to have started the Llanfyrnach, which is working at present, but by a private gentleman, whom it pays well.

Some twenty years since Mr. Gibson was the second largest shareholder in Wheal Franco, and East Wheal Friendship was started by him, whilst from Wheal Mary Emma he was enabled to exhibit in 1851 a sample of tin ore pronounced to be one of the best in the Exhibition; and last, though not least, he was head and chief of the Royal Hiberian Mines, where he gave a *fête* in May, 1852, to some 60,000 persons, and clothed his directors in green and gold. Mr. Gibson has now taken up Pentwyn, and has tendered for a rotary engine to work it. He deserves success, and it is to be hoped that nothing may mar his undertaking.—*Bayswater, Oct.* 20. VERITAS.

[For remainder of Original Correspondence see to-day's Journal.]

MR. HENRY GIBSON has had an interview with the Empress Eugenie at Chislehurst, which he considers as likely to result advantageously: since then Mr. Gibson has received the following letter:—

Campden-place, Chislehurst, Oct. 19.—The Secretary of Her Majesty has the honour to transmit to Mr. Gibson the sincere thanks of the Empress, who has been greatly touched by the sentiment of sympathy which Mr. Gibson expresses towards France and the Imperial family. The packet sent by Mr. Gibson will be forwarded to its high destination.

GOONINNIS.—A company is being formed for the working of this mine, which is situate in the St. Agnes district, and which was formerly worked by tributers of the immediate district, who abandoned it owing to the want of sufficient capital. Excellent reports of the productiveness of the mine and the value of the lodes have been given by eminent authorities.

EAST HARPTREE LEAD WORKS.—The prospects of this undertaking, under the new management, have assumed a more favourable appearance than could have been expected by the most sanguine. The financial position has been thoroughly adjusted, and the liabilities liquidated. The returns for September were over 13 tons of pig-lead, realising 231*l.*, against a cost of 127*l.* The wet weather having now set in, an increase in the returns may be fairly calculated upon, as washing will be resumed by means of the buddles, the same having been suspended on account of the scarcity of water.

Meetings of Mining Companies.

WICKLOW COPPER MINE COMPANY.

The half-yearly general meeting of shareholders was held at the offices, Grafton-street, Dublin, on October 15,

Mr. JOHN BARTON in the chair.

Mr. WILLIAM S. KILDAHL (secretary) read the advertisement convening the meeting.

The CHAIRMAN, in moving the adoption of the report (an abstract of which appeared in last week *Mining Journal*), said—

You are called together as usual to receive the statement of accounts, and of the half-year's transaction of the company. I believe they have been in the hands of the gentlemen present for some time, and I hope that they will be favourably looked upon, as indeed they should when we consider the severe competition which has prevailed for the last six months by the importation of foreign ores. We—the directors—do hope, however, to very materially neutralise the interference in future by carrying out the terms of a very important resolution unanimously adopted by us—namely, by becoming a manufacturing as well as a producing company (hear). I do not now intend to go into any of the particulars or reasons for our coming to the conclusion, further than to say that the question has received the greatest and most earnest consideration of the board, and that they have all seen the absolute necessity of its being carried out. The report now in your hands gives a general view of the measure; and for any information which proprietors may require in addition I will refer you for to our manager, Mr. Barnes. There is another gentleman present—one of our directors—who has taken a great interest in the proposed change, and whose perseverance and ability has considerably promoted it—I mean Mr. O'Brien. He, too, may give you an account of the circumstances that have led to the undertaking we have in view, and the prospects which it holds out to us. I will conclude by moving the adoption of the report and statement of accounts.

Mr. WILSON seconded the resolution, which was unanimously agreed to.

The CHAIRMAN then moved "That a dividend of 2*s.* 6*d.* per share for the last two half-years (ending Sept. 1, 1870), free of income tax, be now declared and registered on the books of the company, payable to shareholders on November 1.

Mr. CHARLES H. CHAYTOR seconded the proposition, which was also adopted *nem. con.* On the motion of the CHAIRMAN, seconded by Messrs. E. BARNES and G. TAYLOR, it was resolved—"That Octavius O'Brien, Esq., and Robert Culley, Esq., be re-elected to the board of directors, and that Mr. Robert Callwell be re-elected auditor for the ensuing year."

A SHAREHOLDER suggested that in place of proprietors individually seeking information regarding the proposed changes from the gentlemen named by the Chairman, it would be well to make a general statement now for the benefit of all parties concerned. (Hear, hear).

Mr. E. BARNES then explained the nature of M'Dougall's new patent furnace for the utilisation of "smalls," one of which is in the course of erection at the works near Arklow. Its operations had been inspected in England; there having been, up to the present time, 300 tons of "smalls" operated upon with the most satisfactory results. Mr. O'Brien and himself, together with their secretary, Mr. Kildahl, had spend three days of the previous week inspecting the process. He had been there two ore three times himself before, and the result on all those occasions was that each 26 cwts. of "smalls" produced 1 ton of sulphuric acid, at a cost in round figures, of 30*s.* The residuum also produced 5 cwts. of red pigment, worth 3*s.* per cwt., or 3*l.* per ton, and 5½ lbs. of copper. If the process was as successful as they believed it would be, they hoped to make a profit of 30*s.* per ton on "smalls," of which they had at the present moment no less a quantity than 30,000 tons, with a daily increasing supply. They had also discovered that the "smalls" possessed the power of sustaining heat—that was, the furnace having once been lighted, and a continuous supply being made, they (the "smalls") would burn themselves. On the whole, they believed that the change would be most advantageous one, and that it would enhance the value of their property very considerably. Every attention has been given to the system, and they had not the slightest doubt, in fact, of its ultimate success.

A SHAREHOLDER enquired if the 30,000 tons of "smalls" alluded to were independent of the 4000*l.* worth mentioned in the report?

Mr. BARNES replied—Quite independent of that.

Mr. CHAYTOR observed that the 30,000 tons had never been included in the accounts.——Mr. OCTAVIUS O'BRIEN said he might be allowed to enter a little more into details concerning the proposed new undertaking than his friend Mr. Barnes had done. (Hear). As they were aware, the company was originally formed under somewhat peculiar circumstances for mining purposes. The property consisted of a mine of iron pyrites, which met with a very large sale, and from which, as they would remember, very considerable results followed for the benefit of the shareholders. For the last four or five, or perhaps 6½ years, however, they (the directors) were sorry to say, that there had been a market depression in the value of the ore—a change which had greatly affected the income and profits. On a reference to the reports made each half-year, they would find that subject prominently dealt with, and regrets expressed that the state of the opposition from foreign supplies had greatly deteriorated their hitherto prosperous position. They were possibly aware that of late a very large amount of sulphur ore had come from the South of Spain and the South of Portugal, and that these quantities had increased, and were increasing, each half-year. And the fact was that, in consequence of the presence in that foreign ore of a large quantity of copper, it had reduced the price of their pyrites to such an extent as to preclude their attaining to previous results—reduced their prices, in fact, from 30*s.* to 15*s.*, which state of things must speak for itself. (Hear, hear). He believed that, in presence of Mr. Barton, he might say that so far as the condition of their mine, the application of the machinery, or the productive results were concerned, their property had in no way deteriorated, so that had they continued to obtain a fair market for their legitimate business they would have been as well off as ever. After six half-years of, he might say, misfortune, and having during the whole of that time considered how best they could develope their resources, they had at length come to the conclusion to take to manufacturing (hear). Having arrived at that point they cast about for knowledge, and had now hit upon a mode of manufacture which would in results inevitably turn out to be most satisfactory—that was the process already explained to them. By that process, and with the materials which they had at hand, even with the drawback of carriage, they would be able to manufacture sulphuric acid upon terms cheaper than any other company. They had now in the course of erection one of the furnaces referred to by Mr. Barnes, and would shortly commence their new business. They had also entered into an agreement to purchase the Arklow Chemical Works, upon terms both reasonable and fair to both companies. They had received the highest testimonials as to the ability and capability of these works, and besides the manufacture of sulphuric acid, they would shortly produce chemical manures, in quantities much larger than they required for their own consumption—a source from which they anticipated adding very considerably to their profit. But, as they all knew, their company, by Act of Parliament, was merely a producing one, so that they would require to take the requisite steps for obtaining parliamentary sanction to the proposed change. All the preliminaries towards that end had been seen to, and immediately on obtaining the new Act they would be in a position to commence manufacturing. They trusted that the course taken by the board would receive the approbation of the shareholders.

Mr. TAYLOR asked would there be a market always available for the sulphuric acid, and also for the red pigment? If they produced a large quantity would they be able to sell it?

Mr. BARNES said from all the enquiries they had made, and from their own observation, they believed there would be a great demand for any sulphuric acid they had to sell. The only difficulty on that head was the carriage. It was a difficult substance to carry. However, their first operations would be in manure.

Mr. TAYLOR—How much a ton will the market value be?

Mr. BARNES.—About 4*l.* per ton.

The CHAIRMAN said a letter had been received from the patentees of the furnace, which showed that from 26 cwts. of smalls, 5 cwts. of pigment could be obtained, the market value of which was 4*s.* 6*d.* to 5*s.* per cwt., or at their works 3*l.* per ton. There was no doubt whatever of a ready sale.

Mr. MILNER asked if these smalls were of any value now?

The CHAIRMAN said they were not of the slightest value.

Dr. E. P. WRIGHT (Professor of Botany, T.C.D.) said he thought the directors deserved every credit for the pains they had taken in this matter. By the employment of these furnaces they could burn up what was otherwise waste. He presumed they would have to encounter opposition some of these days, but they would have such an advantage that no matter what the competition might be they would be able to meet it successfully. (Hear, hear.) They would have double remuneration by using the acid on the spot for their manures. Their manufacture required about 50 per cent. of sulphuric acid. They had to make this by the old process; they would make it now by the new process, which would be all profit. He believed they had to pay 15,000*l.* to the Arklow Company for their premises and machinery, and it occurred to him as much more money to carry on the works in a way that would be profitable. He would suggest that the sum be large enough to enable them to turn out as much stuff as would realise a profit on the amount. In other words, his object was that the board should have power to raise enough money to enable them to send out as much manure next spring as would be taken up. (Hear, hear.)

The CHAIRMAN said he thought he might on the part of the proprietors, and he certainly could on the part of the directors, thank Dr. Wright for the valuable observations he had made with regard to their concern and its expectations. As to the amount the company would require for its new trade, that would be a subject for the consideration of the board. They would probably require 15,000*l.* more, and have to raise the money by the issue of shares.

Mr. O'BRIEN said that in their new Act of Parliament they would have to go for increased capital, and they proposed to increase the capital to such a sum as would leave a margin available for the purpose of any development that time might suggest as prudent to adopt. That Act of Parliament, with all its details, would be brought before the company at a subsequent period, when a Wharncliffe meeting would be held.

Mr. DARCY asked did the directors intend to issue the shares at premium or at par?——Mr. O'BRIEN said they would take the power of raising about 30,000*l.* or 40,000*l.*, but nothing had been concluded upon the subject; they should be governed by circumstances. As to how the shares would be issued, that was a matter of which they had not thought. They would make a recommendation on the subject to the shareholders. They would require from 10,000*l.* to 15,000*l.* over the purchase money.

Mr. BARNES wished to say, in answer to a remark by Dr. Wright, that they had secured the patent for the improved process for all Ireland, so that they might fear no competition.——Mr. MILNER moved and Mr. R. WILSON seconded a vote of thanks to the Chairman and directors for the able and careful management of the company's affairs.——Passed unanimously. The thanks of the meeting were also accorded to Mr. Barnes, the resident director.

THE NEW QUEBRADA COMPANY.

A general meeting of shareholders will be held on Nov. 2.

The report of the directors states, the whole capital of the company having been called up, it is the duty of the directors to explain clearly the steps by which they propose to secure and to develope profitably the valuable property of which they are the possessors. The report is divided under three heads—the past, the present, and the future. Under the last, three schemes are submitted—

FIRST SCHEME.—To offer to the shareholders and the public the 21,000 unissued B shares, which would yield 105,000*l.*, and to raise the remaining 145,000*l.* by debentures. Nothing can be more improbable than that, without some additional inducement, new shares would be taken at par whilst the present already issued shares are at a heavy discount. If the new B shares were made preferential an inducement would be created; but, in order to give the new shares an advantage over the old, it would be necessary that the consent of every individual shareholder should be obtained, and of this absolute unanimity there cannot be the slightest hope. For these reasons this scheme must be dismissed.

SECOND SCHEME.—To form an independent company for the construction of the railway, the function of which should be simply that of carriers to the present company. This scheme, having much to recommend it, underwent long consideration by your directors, who, however, were met with the difficulty that such a company would require a guarantee that the traffic should never fall below a fixed minimum; that such guarantee must consist of a mortgage on the estate, and that temporary and accidental causes, diminishing the traffic, might thus involve a loss to the shareholders of their entire property. The interests of the two companies would, moreover, be in some respects antagonistic.

THIRD SCHEME.—To wind-up and reconstruct the company with new capital. Of the numerous ways in which this may be done that have been considered by your directors the following is the one which they think most equitable and most likely to prove successful:—

The new company to be formed with a capital of 500,000*l.* Of this, 250,000*l.* to be given to the present shareholders in paid-up ordinary shares, so that they may hold precisely the same amount of stock in the new as they had done in the old company. The remaining 250,000*l.* to consist of 10 per cent. prior preference shares, to be offered, in the first instance, to the present shareholders, and afterwards to the public. If found desirable a portion only of this amount would be issued, the remainder being raised by debentures redeemable by drawings distributed over a term of years, so as to keep the capital account as small as possible. In order to effect this operation two things are necessary:—First, the addition to the board of a few gentlemen influential in financial circles; and, second, the employment of a contractor of the highest character and standing, for the construction of the railway. From the negotiations which your directors have been for some time carrying on with contractors and capitalists of the highest position, they fully believe that they will be able to secure both these desiderata, and also the ulterior objects of placing both the new preferential shares and the debentures. They do not, of course, pledge themselves to do this; but, unless they had reasonable hopes of succeeding in the attempt, they would not trifle with the shareholders by proposing that it should be made. Nor would they feel justified in proposing it at all if they did not entertain the strongest conviction that the varied sources of revenue comprised in the estate will yield profits that will give very large returns on the augmented capital which they have named.

SILVER MINING IN MEXICO.

The following report from Mr. Clemes contains so many facts, showing the value of the silver mining district of Sonora, that it will be read with interest by many of our readers. The statement has been prepared for the information of shareholders in the Almada and Tirito Mining Company, and will be read at the meeting on next Monday:—

AFFAIRS GENERALLY FROM THE END OF MARCH, 1870.

At the time of my arrival (March 25) I found the Almada and Tirito Mines in the condition as represented in previously published reports, with this difference that the production in the latter had been reduced to 4 tons per diem; not from failure of productiveness, although the lode going south had been dislocated, but the system of stoping adopted. And in the former all working had been suspended through want of pumping gear for sinking Providencia shaft. We found no difficulty in at once doubling the production of Tirito, and since then have trebled it, having now 15 heads of stamps in constant operation, reducing per day 12 tons picked ore. (The ore is pulverised to pass through wire gauze of 4900 meshes to the square inch, hence the apparently small duty of the stamps.) The ley of the ore is from $50 to $60 per ton of 2000 lbs. Besides this class of ore, we temporarily reject a quantity of "mine smalls," which contain about $25 per ton. This we shall soon treat, and I hope with a fair margin of profit, the ore being very docile. The production also includes from 2 to 3 tons per month of *petanque*, or argentiferous copper ores, reserved for shipment, and containing silver about $400 per ton, and copper 30 to 40 per cent. The rate of yield thus indicated has given a profit of about $5000 per month, excluding expenditure on capital account, such as construction, &c. The returns so far have been derived solely from the Tirito Mine, none of the ore ground of the Almada Mines having been brought to bear. The principal operations have been as follows:—

In TIRITO.—Driving north and south on the course of the lode at the level of the tunnel; opening ground for stopes above that level; timbering and filling up the excavations with refuse from the ancient workings overhead, so as to avoid the necessity of leaving large pillars of valuable lode; sinking a winze or trial shaft below the tunnel, and more recently cutting ground for machinery preparatory to sinking a main shaft.

In PROVIDENCIA.—Driving south from the shaft into Tirito at water level to facilitate the work of sinking for communication with Tirito tunnel.

At SURFACE.—Erecting additional five heads of stamps, cutting space for others, building assay and retort-house, with the necessary furnaces; building dwelling-house for officials in an elevated position to escape the miasma which is found to exist lower down; building powder-house and cutting ground for patio extension, &c. In respect to the mining facilities of the locality, I find by my four months' experience of it that there is every prospect of being able to command an ample supply of labour for a large scale of working, although we have had some difficulty on this score to commence with. Miners earn $1 to $1½ per day; other labourers, 62½ cents. Wood for fuel is also to be had in ample quantity at $5 per cord of 128 cubic feet, but we shall have to cut four or five miles of wagon-road to keep the price within limits. Salt, of which about 5 per cent. is added to the pulverised ore for reduction, has been unusually high, $5 to $6 per fanega of 300 lbs., owing to the destruction of the salinas by floods last year, but we can see our way clearly to get the price down to $4 or even $3. You are aware that we use the patio process for the reduction of the silver. In the dry season we find the loss on ores assaying (say) $70 per ton to be 20 per cent.—that is, they yield about $56. But the percentage of loss necessarily varies with the quality, being less for richer ores of equal docility, and *vice versa*. The cost per ton for milling and beneficiating has been from $8 to $10. The whole question of reduction has my full attention, and I believe we shall secure results as satisfactory as can be hoped for. I refer to the cost for mining only to explain that any comparison at present made would convey a false impression. Mining cost per ton, which includes expense of supervision, watching, and a portion of the general establishment charges, is necessarily out of proportion at the commencement of operations, and while only a fractional part of the property has been developed.

PROSPECTS OF THE MINE.

TIRITO.—The lode, as will be seen marked on the plan, is from 15 to 21 feet wide. Driving south it was intersected by a fault, which for the present has terminated its productiveness in that direction. There are good reasons for further explorations here, but in my opinion the main ore deposits of the property lie from this point *north*. Driving north towards Providencia, at the time of my arrival, the lode was in full size and productiveness, affording every prospect of a steady increase of returns; but recently, as you have been informed, we have encountered a slide, which cuts obliquely through the lode. It proves to be large and hard. We had driven into it 25 feet before I left; probably by this time it has been cut through, and I have strong hopes that the water, which it has undoubtedly been the means of damming up in Providencia, may now drain off, and enable us to place the ore deposit of that mine more rapidly in course of working. The position in Tirito, therefore, is this:—The lode is proved to be productive for 240 feet in length, while in height we are bounded by the ancient workings, and they have been touched at points only 60 and 80 ft. above the bottom of the tunnel. We had worked away a considerable portion, and the area remaining at our disposal is comparatively limited (see section). It is, therefore, necessary, pending the laying open of Providencia ore ground, to sink below the tunnel with all dispatch; and, after full consideration of the circumstances of the case, I have concluded that it is better at once to erect a small pumping and winding-engine underground than to commence with horse-power. The lode, as seen in the bottom of the tunnel, is large and valuable—$300 to $400 per cubic fathom. The water, I believe, will not be much, but we cannot avoid pumping.

PROVIDENCIA.—In this pertenencia we have been driving south to form an easy exit for the water, so as to sink without the aid of expensive machinery, and by this time I hope everything is in course for sinking. If, as I think it very likely, the water has been tapped by cutting through the slide in Tirito tunnel, as already adverted to, the work will advance rapidly. The principal ore deposit of Providencia we believe to be directly under the shaft, and there may be another close under the slide. It will, probably, take 10 months to effect a direct communication between Providencia shaft and the tunnel; meanwhile we shall obtain some ore from the ground to be passed through, but I see no sufficient reason for expecting returns of consequence from this pertenencia within the half-yearly period now entered on.

MINA GRANDE.—In this section of the property we have not yet done any work except to fix ladders, &c., to make it accessible, in anticipation of driving in from Providencia; here we all believe the principal ore deposit is to be found, but to reach it we must either wait for the tunnel to be driven, or clear a new passage from the surface. It will still take about two years to extend the tunnel to the desired point, unless the ground becomes easier than we have had it so far, so that it may become sound policy to get down in advance of the tunnel. I would only defer a decision on the question until, having cut through the slide, we see the character of the ground, and whether the water drains off, meanwhile the Mina Grande deposit must lie intact.

REQUIREMENTS AT SURFACE.

To derive full advantage from our proximity to the coast for the transport of ores and supplies, we shall have to cut a road to join the present wagon-road to Ybarras or Ajiabampo, about nine miles in length, the greater portion requires only to be cleared of small timber, and I estimate the entire expense will amount to from $5000 to $6000. The roads from these places to Alamos do not touch into the mines, high ridges, impracticable for a wagon-road, intervening at the nearest points. We require also an engine for 30 stamps, 15 in addition to those now working, with two pans only to commence with. The cost will, probably, be $15,000 complete. We do not require these additional heads at the present moment, but it is time to get them ready. Also a winding and pumping engine for Tirito at a cost of about $7000. Our other requirements on capital account will be small, unless we have to sink in Mina Grande.

PROBABLE IMMEDIATE RESULTS.

From the description of Tirito, Providencia, and Mina Grande, it may readily

be seen that for the current six months we shall probably have to depend solely on Tirito for returns, and owing to our position there, as explained, and the work to be done before bringing a new section of ore ground under command, I cannot fairly promise within the period named an increase upon the present rate of production, so that the results will be similar to those of the past four months. Should we soon cut ore under the slide, as is very probable, the case will be different. This estimate of results at the present time is no indication whatever of the capabilities of the mine when further developed. The present rate of extraction is insignificant compared with what we have every reason to expect, but the expenditure of time in laying open a property of this kind is unavoidable. Notwithstanding the intersection of the lode by the slides, my opinion of the mine generally is better now than before I commenced worked it.

San Francisco, Aug. 30. J. P. CLEMES.

[For remainder of Meetings see to-day's Journal.]

NANTEOS CONSOLS—SPECIAL REPORTS.

Sept. 14.—By your request I have carefully examined this mining property—first, that part known as Penrhiew, in and upon which the operations of the present company have mostly been confined. In considering your chances of obtaining success it will be necessary to adduce in evidence the results arrived at by your operations, and to refer to the state in which the mine was at the time of your entering upon it. At that time you had the shaft sunk and in order, and the levels mostly driven, which to you was a great advantage in time and money, and hence you were able at once to operate upon the lode and quickly to determine its value, and while the result has not been ruinous, it has, in my opinion, sufficiently shown the high improbability of your obtaining a fair return for the capital that has been and must be further supplied if you would continue to work this part of the mine. It has been remarked that with increased depth the sulphur and other corrupting matter in the lode becomes less, but I fail to discover any uniform evidence of this, as it appears plainly that if in the upper sections of the lode there was more sulphur, there was also more lead, where it was productive of that mineral, as judging from the extent of the old workings the lode must have been larger; however, there is ample proof adduced both by yourselves and those who wrought this lode before you that it does not produce sufficient lead to pay for extraction, except in some isolated portions, and that, too, uniformly it is corrupt, deceptive, and commercially unprofitable. I find, including the parcel of lead now nearly ready for sale (say 25 tons), that the produce of lead will have amounted to 77 tons, and this at 12*l.* gives 924*l.*, and say 25*l.* for blende, makes a total of 949*l.*, while the working cost from June, 1869, to end of August, 1870, is said to be 992*l.*, leaving a deficiency of only 43*l.* Now, this seems a small loss, and under certain circumstances would be quite insignificant. But it must be borne in mind that the whole of the works underground have been on the lode, from the fact that the shaft and levels were ready for your operations, and hence the result is important. It should also be borne in mind that this is not a new mine, and I believe I am safe in saying that those who wrought this lode before you shared no better fate, and I am forced to the conclusion that it is one of those unfortunate undertakings which may be said to be almost too good to abandon and too poor to work.

I refer again to the suggestion that under such a large deposit of sulphur the chances of success are good, but from the character of this lode I am not of that opinion, and for the following reasons:—If from the first point at which the lode became productive of lead there had been a uniformly increasing quantity with increased depth, however small, found in it for a given length, it would, in my opinion, favour such an idea, but in this case the lode has been found productive in one level, while in the next below it has not been so. At corresponding points, and again in a still deeper level, it has been found productive and holding up in the roof 5 fms. or so, and down to an equally unsatisfactory extent, and, therefore, all things considered, I think the chances of success at deeper points are slender indeed. But, notwithstanding this opinion, it might be desirable under certain circumstances to try an experiment by sinking deeper. But I presume you are not in a position to go into experimental mining, and, therefore, I recommend you to at once suspend active operations on this part of the property, and devote your capital to the development of that portion where, in my opinion, you have a very fair chance of success at an early date.

There can be no objection to working any part of the mine on tribute; there is no charge for draining the mine, and few mines can be wrought more cheaply. Your drawing and crushing power is all complete, and your dressing-floors, and doubtless many tons of ore may be extracted on tribute at a small profit now, as men on tribute will be more careful to select the better portions of the lode, but if done on tutwork (piece work) I am convinced there will be a loss.

It has been suggested that during the time your company has had the mine that more ore might have been extracted, and this would seem to imply that there are considerable reserves of ore in the mine, but I can only say I can discover no such reserves, and it is clear that the agents have selected the very best portions of the lode for extraction, and if more lode had been extracted it must have resulted in a greater loss. While on this subject I may refer to a request made by the managing director "that I should examine matters generally, and determine whether the mine has been improperly managed or not underground," and I can only say that I fail to see anything improper, and that under the circumstances under which the mine was taken by your company it would be difficult for any miner of ordinary capacity to err in carrying on the mine, as the lode was already discovered, and a leading feature and a guide, while the shaft was sunk and most matters ready to hand, so that no very high scientific attainments were required to extract the lode which was in view. But I do find that the large quantities of ore which were said to have been discovered left standing by former workers, and that you had only to simply break down and send to surface, were entirely unfounded.

BWLCH GWYN.—The elements of success in this part of your property are seemingly of an unmistakable character. There are many features of an interesting and important nature, but most noticeable for immediate attention are the driving of the 30 fm. level eastward, on the north lode, and of the 40 in the same direction on the south lode. This south lode in the 30 must have been from 6 to 10 ft. wide, and largely productive, and its character and composition for continous production in depth is most promising, being composed of friable and compact quartz, carbonate of lime, a little blende, sulphur, and lead of a rich quality. There is very little of the contaminating substances here that are to be found in the lode at Penrhiew, and the lead is such that were you have it you can safely calculate on the quantity. I most fully believe, judging from every feature presented—nature, constitution, and size of lodes, extent to which they have been extracted by your predecessors, and the easy and cheap way in which you can operate upon them at once, having them drained by deep adit, your shaft sunk, and levels driven (matters of large importance in mining)—you have a fair prospect of going to market with ore at an early date. In view of all these very favourable circumstances, I unhesitatingly recommend you to at once put the shaft in order for drawing as soon as possible, and commence the driving of the 30 east, on north lode, and the 40 in the same direction on the south lode. These are the most important points to start with, while there are others of a secondary character, which will demand your attention in due course. You have your wheel erected for drawing and crushing, and a drawing machine and crusher on the ground, and the sooner those appliances are put in position the better, but first the drawing gear and shaft, as those will enable you to begin operations underground which cannot be done previously.

In conclusion, I would remark that while you are opening out new ground at deeper points there may be taken away from several places more shallow some good ore for the dressing-floors, which will, of course, be selected at the discretion of the agent, and with due care as to its commercial value. But of the utmost importance is the opening out of the lodes under the points where they have been so largely productive in the upper sections of the mine.

RICHARD WILLIAMS.

NANTEOS CONSOLS.

Sept. 9.—After a careful inspection of your mines, I beg to send you the following particulars, and in so doing I shall curtail my remarks as much as possible, and endeavour thereby to give an unbiassed opinion as to the issue in future of this extensive mineral property, which embraces an innumerable quantity of lodes, some of which are of the finest character, embracing every element of great success—in fact, practically speaking, the backs of these lodes are a mass of gossan and sulphur. And after a lapse of 15 years even at the 30 fm. level, at Bwlch Gwyn, the appearances are such as no man would say less than "go down to dig up the hidden treasure which must be underneath." The water oozing from the lode has formed a carbon of perfect whiteness, with blue stains of copper water, formed into stalactites of every imaginable shape; I mention this circumstance merely to show that the lodes are not diminished in strength in depth.

Penrhiew engine-shaft has been sunk to the Ystumtean deep adit level, and for 30 fms. deeper, but only the 10 and 20 fm. levels have been extended on the lodes; the last 10 fms. in sinking nothing had been done on the lode east or west of shaft. It is quite evident, from the nature of excavations, that large returns of ore have been made from time to time. Various levels from the adit upwards (the 36, 26, and 16 fm. levels) have been productive of ore, and in several places at present the lode shows signs of a successful future. A winze has been sunk 10 fms. under the 26, west of engine-shaft, through a good-looking lode. Here the men are stoping each end of the winze; lode yielding 15 cwts. of lead ore to the fathom. The 36 should be driven under this run of ore ground at once; the advantages from this would be considerable. There is a stope working by two men, nearly 30 fms. west of this winze, yielding ½ ton of lead ore to the fathom. The present end (the 26) is poor, although 3 fms. behind this end there is a tolerable good bunch of ore, and in several places at this level there is ore ground that can be taken away to a profit. I should, consequently, recommend this being done, the 36 being driven, and a cross-cut to be put out north to intersect a north lode, worked on at surface in the Ystumtean Mine, and within a few yards of your boundary. This lode is of a masterly character, fully 7 ft. wide, with well-defined walls, bearing 20° north of west and south of east, with south underlie. The distance at right angles would be about 40 fms., and the cost for driving about 6*l.* per fathom. I would suggest that this be done at the western extremity of your mine, and at the 16 fm. level, so as to enable you to throw all the stuff down the learies, instead of drawing it to surface, as you would have to do from any other level.

BWLCH GWYN.—I was surprised to see such extensive workings, more particularly at the 30, near the eastern shaft, where there had been a continuous run of ore ground for 50 fms. long, with an average width of 7 ft., in many places 10 ft. wide. This ore ground reached to near the surface. A 40 fm. level has been extended a considerable distance east of Bwlch Gwyn engine-shaft, but has yet a distance of about 30 fms. to drive to get under this run of ore ground. Why this has not yet been extended home to this ore ground I am at a loss to understand, for, drawing an analogy with the most reliable information, the former workers must have been enabled to return from this bunch of ore ground alone 40 tons per month. I do most strongly advise your fixing ladders in the Bwlch Gwyn engine-shaft, from the 30 to the 40, and case it down, for the purpose of drawing your stuff clean and secure from the 40 fm. level, and drive it on with the utmost vigour to the point named, when, in my opinion, your position would be good, and, if so, go back to the shaft, and bring on the deep adit level, which is 6 fms. under your 40 fm. level. These points can be carried out with most favourable auspices, having no water charges to contend with, neither any pitwork to purchase or to fix; simply erect your drawing-machine which you have on the mine, and with a powerful wheel to work it. In fact, you have every advantage here for the carrying out of a mine of any magnitude. To dwell on the different lodes, drivings, and excavations would be simply a folly, although I shall at any time be pleased to refer to my notes and make abstract, if you so require it; but I will add that looking at the position of the Nanteos Consols, with the similar state of the best mines now surrounding it a few years ago, I am of opinion that a fair capital, judiciously laid out, would make it a valuable property. Many a present paying mine in this district would never have reached that enviable position if allowed to remain in the state by former workers such as the Nanteos Consols is at present; and within a period of 25 years, and subsequently, all dividend mines north of the River Rheidol were old abandoned mines, and now the district contains, in a given area, more paying mines than any other in the kingdom. There is on the mine adequate machinery for all requirements, with good offices, smiths and carpenters' shops, &c., with a never-failing supply of surface water.

JOHN TREVETHAN.

The Powell United Mines (Limited), near Aberystwith.

RHYDTALOG MINE—SPECIAL REPORT.

The immediate district in which this mine is situated, although traversed by many well-defined lodes, has received but little attention from the miner, and its mineral resources have still to be developed. The properties that have been worked in its neighboured have been so to great advantage, in consequence of their geological situation, and profitably on account of their richness. The Llanfair, Lisburne, and Nant-y-Mwyn Mines are the nearest points to Rhydtalog where mining operations have been carried on. The mine is situated in the parish of Llandewi Brefi, in the county of Cardigan, about nine miles distant from Llandovery or Tregaron, at both of which towns there is a railway available for carriage of materials and minerals. The grant extends for about two miles on the course of the east and west, and about one mile on that of the north and south, lodes. The stratification is killas or clay-slate, of a nature found in the country to be very congenial for the produce of mineral, as well as favourable for mining operations. From the engine-shaft two lodes are being worked—the main lode and north and south lode; a third, supposed to be the Llanfair silver lode, will shortly be intersected. The main lode is composed of killas, prian, spar, silver-lead, and blende; it is 2½ ft. wide, with an underlie south of about 2 ft. in a fathom; its bearings are 35° north of west and south of east. The caunter lode is composed of killas, spar, and silver-lead, 2 ft. wide, with a westerly underlie of 2 ft. per fathom; its course is 35° west of south. The new lode has been seen at surface only, where it has a very promising appearance, being well-defined and productive of silver-lead; its bearings are due east and west, and will be intersected by the caunter lode at the 15 fm. level, at a distance of 15 fms. from the main lode.

The main lode, in the 15, produces 1½ ton of silver-lead per fathom; the caunter, 10 to 15 cwts. The new lode has not been sufficiently proved to determine its average produce. The main and caunter lodes have been developed to a depth of 15 fathoms, above which, to within 4 fathoms from surface, they have been worked out. The engine-shaft and a winze are sunk below the 15, and both points are rich; it is, therefore, determined to continue the development in depth on the main and caunter lodes, at the same time cross-cut to intersect the new lode. The produce of the mine is particularly valuable on account of its richness in silver. The following are the assays of two samples taken from the lodes:—No. 1, lead, 75 per cent.; silver, 89 ozs. per ton. No. 2, lead, 80 per cent.; silver, 49 ozs. per ton. The necessary machinery is erected for pumping and drawing. The large water-wheel will drain the mine effectually to a depth of 60 fathoms, and the smaller wheel is calculated to draw from a similar depth. The river which forms the eastern boundary of the sett will supply power to work the machinery necessary to drain the mines to a great depth, as well as to draw the ores to surface. There is also an ample supply for the purposes of crushing and dressing the ores. The local management is conducted by a skilful practical miner, of great experience in the mines of Wales and Cornwall. The finances are under the control of directors, gentlemen connected with the principal mining enterprises of the day, and thoroughly competent to administer the funds of the company. The success of the mine may be said to be attained as the lodes already developed, as well as those in reserve, are proved to be not only productive, but richer than the generality of those of the county that have been remunerative. The prospects for the future are, therefore, very encouraging, nothing more than a judicious expenditure of the capital, with careful and economic working, being requisite to bring the mine to a dividend-paying state, and to increase its value as the profits increase and the operations are extended.—CHARLES THOMAS, Oct. 20.

COLLIERY MANAGEMENT.

The advantage of theoretical knowledge to practical men has been so frequently pointed out in the *Mining Journal*, that the publication of a work of the character of Mr. Hyslop's* cannot but be regarded with satisfaction. The author tells us that the substance of the volume was delivered in the form of weekly lectures to a few young men who were seeking instruction in colliery management, and, judging from the book, it seems evident that they did not seek in the wrong quarter. His primary object, he says, being to instruct those who have less knowledge and experience than himself, he has endeavoured to prepare such a book as would have been useful to himself when a beginner. The recollection of his own difficulties in obtaining professional education, and a grateful remembrance of the kindness of those who helped him, has done much in guiding his pen in the matter. Commencing with a general consideration of the question of technical education, he proceeds to explain surveying, levelling, and cognate subjects, and to give his readers an insight into the principles of mensuration, searching for minerals, steam-engines, and of getting, transporting, and selling coal, as well as avoiding accidents in working it.

A more just appreciation of the extent of technical education requisite to working men than that shown by Mr. Hyslop need scarcely be desired, and his observations are most judicious. The common branches—such as reading, writing, and arithmetic—are, he remarks, the great foundations, and, consequently, applicable to all, but, inasmuch as in after life the callings and pursuits of men are widely different, and each has its own peculiar requirements, it is obvious that after such fundamental acquaintance with those has been gained the teaching most valuable to a man is that which most nearly concerns his daily employment, and best fits him for its performance. Not that a man must needs lay everything aside, and devote all his energies always to the mere requirements of his profession or employment, but this should have the principal share, and the fewer odd moments be devoted to other branches, and the acquirement fo general intelligence regarding men and things. In most of the important occupations a certain amount of training and technical knowledge is absolutely required, or a man can never rise above the first step in the ladder of promotion. Another argument for special training is the increasing competition in the trade. As in everything else where a few have succeeded a crowd has rushed, so that in the scramble for mineral fields rentals have proportionably, or more than proportionably, risen while at the same time the supply has been doubled every ten or fifteen years, till now our national output of coal is 110,000,000 of tons. Referring to the causes of failure of the Glasgow Mining School, he observes that employers had too much to pay, were too extravagant in their expectations, and were, consequently, disappointed. Another reason for failure was the fact of its requiring a continuous residence in Glasgow, which though the fees were low made the expense considerable. For his own part, and there are but few who will not cordially agree with him, he does not see the need of anything like a charity school for intended managers. They ought to have as much self-respect as to pay their own way, and support their own teacher; for, as he very properly suggests, if they have capacity for managers they will have sense to see that the position is worth a struggle, and if they be in earnest they will accomplish such self-denial.

In the chapter on Surveys he remarks that the want of proper and preserved plans in the past has been the cause of many disastrous consequences in our own day. The absence of them in any case necessarily entails the absence also of accurate knowledge and intelligent foresight. Upon an accurate and complete plan depend in no small degree the economy and safety of the mine. Hence the importance of having plans, and the desirableness of all managers being able to prepare such for themselves, for no surveyor coming half-yearly can prepare a plan equal to the resident manager who is up to the work. When a manager can survey and prepare his own plan he is ready for any emergency, can get on every bit of his workings, and know exactly what he is doing. To enable the requisite knowledge for accomplishing this to be acquired with facility Mr. Hyslop gives an excellent account of the mode of surveying with the compass, prefacing it with the few facts and definitions in practical geometry which it is necessary should be known to the beginner, and having thoroughly described compass surveying he devotes a chapter to the consideration of surveying with the theodolite, and in the succeeding chapters levelling, plans and sections, and mensuration generally are in turn referred to.

Having disposed of the surveyor's portion of the subject, Mr. Hyslop next deals with the matters more immediately within the province of the coal miner proper. In the chapter on Mineral Search he gives a very good geological chart, showing the order of succession of the various stratified rocks, with their thickness and mineral characters, and offers some very useful hints upon boring operations. In that on Mineral Leases he gives ample information to prevent an intending lessee from permitting unusual and objectionable clauses being introduced without his knowledge. In referring to the position of shafts, the lease of the coal field having been secured, Mr. Hyslop makes an observation which we think nine mining engineers out of every ten, and nearly every coalowner, will take serious objection to. He says that "having leased a coal field, the next practical question generally is—In what position shall the shaft or shafts be?—and though it is *not of such importance* as some other questions are, it is well worth considering." Now, in our opinion, the position of the shafts is of paramount importance, whether we consider the subsequent safety of the mine, or its profitable working; and we would further disagree with Mr. Hyslop in his opinion that the general error at present is the sinking of too many shafts. In the chapter on Steam-Engines a mass of very valuable information is given, and the chapter on Steam-Boilers is also excellent—his observations on explosions, if attended to, are well calculated to prevent casualties. With regard to the form and sizes of shaft, Mr. Hyslop points out that for an area of 100 square feet the oblong shaft has 272 feet of wall face per fathom, and the circular only 240 feet, a ratio which the timbering also follows, yet he shows that sometimes in Scotland the oblong shaft is both economical, and really the best. In the succeeding chapters erections and fittings, railways and sidings, wagons, and markets are considered, the author in each case giving evidence of having carefully and thoroughly considered the subjects he treats of.

The remaining chapters of the work, nine in number, are devoted to questions connected with colliery operations. Mr. Hyslop divides his observations on Coal Getting into three parts—getting it cheaply, getting it well, and getting it all. He explains that the cheapness depends very much on the system of working, but he points out that when the system is not adapted to the coal to be worked the gain is merely temporary or apparent. Thus, one manager may have worked very wide, and got the credit of being successful in producing a large quantity of cheap coal, yet he may have got the workings in such a state that the remaining coal cannot be removed without great loss. He points out, again, that cheapness depends very much upon the regularity of the work, because the working places always suffer by stoppages, and in some cases to a very serious and expensive extent. Getting coal well Mr. Hyslop defines to be the greatest proportion of coal to dross, and the coal of the largest size; and, with regard to getting all the coal, he observes that when a colliery is fairly opened up and established the manager should feel the importance of making it win the largest total from the field, consistent with economy in other respects, and the whole of his plans should be laid with that view. Not that you are to peril men's lives to get the last ton of coal from a pillar, or to risk the 40 or 50 props that are keeping up the roof for the sake of an additional hutch at the last, simply because the one is of far more value than the other. But, on the other hand, you are bound to get all you can with safety, and not lose even a ton without regret. The long wall and bord and pillar systems are described, and their respective merits, under various circumstances, discussed; and these are followed by a chapter on Dykes and Dislocations, and two others on Conveyance underground and to surface. To Ventilation two chapters are devoted, and these are succeeded by one on Choke-damp and Fire-damp, and another on accidents generally, the concluding chapter referring to matters of general economy, amongst which he mentions a scheme for an Educational Mining Institute for Scotland, notice of which we reserve for a future occasion.

Regarding Mr. Hyslop's book as a whole, the nature of the information given is precisely that which is likely to prove most valuable to those for whom it is intended—men connected with collieries, who have the wish to improve their position, and the perseverance requisite to enable them to gain such knowledge as will entitle them to promotion. It is essentially a Practical Colliery Manual. Mr. Hyslop often writes with reference to the collieries of Scotland in particular, and these frequently require to be worked in an exceptional manner; but as he carefully states his opinions, and his reasons for them, his readers can see at once in what cases he intends them to follow his instructions to the letter, and under what circumstances he would simply teach them to use their judgment to the utmost whenever they have occasion to do so. The volume is handsomely printed and bound, and enriched with a large number of well-executed illustrations.

* "Colliery Management," with illustrations. By JONATHAN HYSLOP, C. and M.E.—Wishaw: David Johnston.

A PROGRESSIVE SERIES OF POPULAR LECTURES ON GEOLOGY.—LECTURE I.

The science of Geology treats of the nature (form and composition) of the substances which go to make up the crust of our earth. We say the *crust*, for though the experienced geologist may make a shrewd guess of what is in the centre of the loaf, yet it is the crust which forms the subject of his study, and this alone affords him an ample field for the acquisition of knowledge. Education, we know, is progressive, and each new thing that we learn is necessarily dependent upon something that has gone before. The alphabet must be learnt before the book can be read, and the book must be read before the theme can be written; and the study of geology is no exception to this progressive rule. We propose, therefore, to divide the subject into four parts, under four distinct heads—Mineralogy, Lithology, Petrology, and Palæontology; and it may be well, before proceeding further, to explain the meaning of these various names, and to point out their connection one with the other, and with the whole science of geology.

Mineralogy, or the science which teaches us the names and natures of the various minerals, may be called the *alphabet* of the science of geology, for the geologist learns by its help the names and natures of those minerals which, in combination with other substances, form the rocks of which our earth's crust is composed; and having completely mastered this part of the subject, he passes on to *Lithology* (from the Greek *lithos*, a stone), which treats, as its name indicates, of stones, or small pieces of rock, "hand specimens," as they are called, and from which he learns how the minerals are combined to form the various rocks; and we may compare this part of the subject to the reading of easy words made up of three or four letters. Then, just as the child passes on to longer and harder words, so the geologist goes on to study *Petrology* (from the Greek *petra*, a rock), which treats of the rocks as they appear in the open field, and from which he learns the larger characteristics of rocks, their planes of division, their forms, positions, mutual relations, and other characteristics which lithology alone could never teach him. And, lastly, we arrive at *Palæontology*, or the science of ancient beings, which treats of the fossil remains of all organic matter, even a foot print or any other trace of an animal being included under the term "fossil."

Having thus given a short account of the four parts into which our subject is divided, it may be well to begin the study of the composition of our earth's crust, by naming those elements out of which it is composed, and they are Oxygen, Hydrogen, Carbon, Sulphur, Chlorine, Silicon, Potassium, Sodium, Colcium, Magnesium, Aluminium, and Iron. Of these twelve elements, which form nine hundred and ninety-seven thousandths of the earth's crust, oxygen is by far the most important. It enters into combination with all the others to form some new substance, so that we may attribute to oxygen nine-tenths of the earth's crust. We may notice, too, that of these twelve elements the first five are the active substances which combine directly with others; but the remaining seven will not combine with each other until they have first been silified, as it were, by a union with oxygen. The principal minerals formed from these elements may be divided into two classes—the Augites or Hornblendes, and the Feldspars, the former being essentially silicates of magnesia, mingled with silicates of lime, iron, and other substances, the latter being silicates of alumina, mingled with silicates of potash, soda, and lime. To the horneblende class belong such minerals as talc (French chalk), asbestos, and others, which may often be distinguished by a soapy feeling, peculiar to minerals of this class. Under the head of feldspars we have garnet, quartz of various kinds, granite, mica, slate, &c. These are distinguished by their crystalline character, and we may add to them clay, which is a bisilicate of alumina. Besides these, however, we may mention chalk, which is almost pure carbonate of lime; and sandstone, which contains 98 per cent. of silica, together with some carbonate of lime. This is but a very rough and general idea of the various minerals, but to enter into detail on this point would be out of place in these lectures, and enough has been said, we hope, to be of some assistance in distinguishing the minerals one from another, and in discovering the elements of which they are composed. So far we have only been considering small hand specimens of rock, and we have found that such specimens are made up of a few minerals, which in their turn are composed of a few chemical elements, and this affords us a basis for further enquiry.

Under the head of *Petrology* we shall now proceed to enquire into the "origin of rocks," for so far as lithology goes the earth might have always been what it now is. We derive no history of the past from this science, but are simply enabled to study the rocks as they now exist. If we seek to find out how the various minerals composing them were brought together, and in what manner the rocks were formed, we must go out and examine them carefully in large masses in the open field, and if we find that forces which we know to be now in action are producing results similar to those which we see in our cliffs and sections of our earth, then we may fairly conclude that the rocks as we find them were produced by the same or similar forces. This being granted, we find that petrology divides all rocks into two great classes—stratified rocks, or those that are found in layers or beds; and unstratified rocks, or those which have no such bedded structure. The unstratified rocks are known in lithology as crystalline, and the stratified rocks as non-crystalline, or those which are described as having a soapy feeling.

The different layers in stratified rocks are of varying thickness, and in a section 20 feet deep we may have as many as 17 layers. It may be interesting to give a short sketch of one such section. We have first a bed of reddish sand, 18 inches deep, without any subdivision; then a bed of limestone, which splits up into thin layers; then clay, and a second bed of clay, with black markings in the upper part, similar to those formed by dead leaves in a muddy ditch, and in the lower part we find sand shells; next comes another bed of limestone, and then another of sand, the lower part of which is much harder than the upper, and on pouring an acid on a portion of it we find that it effervesces, which shows that carbonate of lime is present, and has bound up the sand into a hard mass. Now, if we examine the deposits at the bottom of a lake we find them to be very similar to the sketch given above, and we, therefore, conclude that such rocks were really formed in a lake, the rivers running into it having carried down the mineral matter in suspension in the water, and then deposited it at the bottom of the lake. We arive, therefore, at the general conclusion that the stratified rocks were deposited under water. Again, since the deposits in the lower beds of such rocks belong to sea fish, and those in the upper beds to fish living in fresh water, we know that the lower strata must have been formed beneath the sea and the upper beneath a fresh water lake. Hence these aqueous rocks, as they are often called, are said to have marine and fresh water deposits. And as a link between these we have certain esturine deposits of such fish as live in brackish water at the mouths of rivers, or junctions of fresh and salt water. We find also tracks of marine animals, all perfectly preserved in the sandstone. From these various reasons, therefore, we conclude that the bedded rocks were formed under water. The beds of these stratified rocks

are often wedge-shaped, being thicker at one end than the other while other layers retain about the same thickness throughout their length. This phenomenon is easily explained. The finely-divided clay, which is always found in regular layers of about equal thickness throughout, would, of course, be carried along by the river for some distance into the lake, and then deposited, while the coarse sand is often found as a sand bank would be dropped by the water at the mouth of the lake, or as soon as the river began to get less rapid. A peculiar form of bedding, too, is brought about by the drift, and ripple of water and currents, of course, exercise a great influence on the formation of the bed. These are a few of the chief points to be noticed in the formation of stratified, or non-crystalline, class of rocks. We pass now to the second great class, known as unstratified, or crystalline; and, in the first place, the fact of their being crystalline leads us at once to suspect the manner of their formation, for we know that crystals are formed while the substance passes slowly from a fluid to a solid state. This is one great step in the right direction, and from a knowledge of existing phenomena we are enabled to take a second, which tells us that the mineral matter forming these unstratified rocks must have become fluid by fusion under very great heat, only to be found in the existing volcanoes; and although no modern lava is so compact as old crystalline rocks, yet we find the more it is compressed the harder it gets. We conclude, therefore, that these unstratified or igneous rocks were formed by the eruptions of huge volcanoes; and we may add that melted lava ejected into the cracks of existing rocks would, by its great heat, entirely alter the shape and nature of those rocks. We have yet a third, though insignificant, class of rocks, known as metamorphic, because they have been changed from their original nature. These, while they have the bedded structure of stratified rocks, retain the crystalline character of the unstratified rocks; and this is accounted for by their having first been bedded, and then subjected to a great heat, but not quite sufficient to fuse them, in which case they would have lost, of course, their bedded structure.

We would proceed now to notice and explain a few of the striking features of various rocks, and the most important, perhaps, of these are the joints common to all rocks. They consist of a series of planes of division running transverse to the planes of bedding. These joints were produced, possibly, by shrinking, and are of the utmost use in quarrying, since rocks will often split only along these joints. We have a good example of them in common coal, where they exist in two kinds, the one regular, the coal showing a smooth, shiney face, when split along these joints, and the other very irregular, along which the coal only breaks into small pieces.

Concretionary structure is another feature common to many rocks. It consists in the escape of minerals in small nodules, like the pieces of flint so often found in chalk and the balls of iron pyrites in clay. The centres of these nodules are sometimes occupied by a fossil plant, or grain of sand, around which the mineral matter seems to have collected, how or in what manner geologists are as yet unable to say.

Another feature is the cleavage of rocks, or the splitting into long planes of bedding. Rocks often refuse to split along the natural planes of bedding, while along other planes they will split easily—cleaved rocks split into thin layers, as is seen in the case of roofing slates. This cleavage has been proved to be due to pressure, by an experiment made on a mixture of wax and clay.

Lastly, we have *foliation*, a term which has been applied to those rocks which have had such a subsequent structure given to them as to split into plates of different mineral matter—that is, the component minerals have separated out, and re-arranged themselves in separate layers, very much like stratification. This foliation is due to two pressures in opposite directions.

We have thus endeavoured in this lecture to give a short sketch of the earlier detail of Geology, and we shall hope in the next to pass on to some of the grander and more interesting portions of the subject; but though the preliminary details may be dry and uninteresting, they are necessary to form the foundation of that which is to follow.

SOME OBSERVATIONS ON COAL AND COAL MINING, AND THE ECONOMICAL WORKING OF OUR COAL FIELDS.

BY WALTER ROWLEY, MINING ENGINEER, LEEDS.*

Reference to the reports of Her Majesty's Inspectors of Coal Mines show very conclusively the relative safety of these two systems of getting coal, which, taking the average nature of the coal seams in various districts, will be a strictly just and reasonable comparison. The number of accidents from falls of roof and coal in the Yorkshire coal field amounted in 1869 to 59 per cent. of the accidents from all causes. This refers to a district where long wall is the exception, and some form of bank work—the usual method employed.

Mr. George Fowler, in a recent paper read before the Institute of Civil Engineers, has very ably analysed this important enquiry. He finds that—

"Out of a gross tonnage of 198,636,043 tons obtained by pillar work in 1866, 1867, and 1868, the casualties by falls were 814, or 231,739 tons of coal for each life lost. Of a gross tonnage of 22,899,000 tons extracted by the long wall plan, the casualties were 75, or one life for every 305,320 tons. If the latter ratio existed in pillar work, the casualties would have been reduced from 814 to 614, or a saving of 200 lives."

This happy feature in long wall is produced by the absence of those small and weak pillars of coal which we find in all pillar or bank work. On the other hand, long wall attains its smaller percentage of accidents from the fact that the roads are built well, and there only being a limited area of roof exposed to the workmen, the worn-out and bad roof being allowed to bend itself, and settle upon the old goaf, and, as I previously explained, progressively utilised to help in getting the coal. As the miner advances there is always a new roof to protect him, which has never done any duty before. Then, again, there is another arrangement very general in long wall mines, which the writer thinks greatly helps to bring about these results—that the building of the pack-walls, timbering, and supporting of the roof in long wall mines is usually attended to by skilled men, whose duties are confined to this work, and not by an unskilled hewer of coal, whose only object is to economise his own time and labour. I have observed this evil wherever men are allowed to timber and build the roads for themselves. This beneficial rule might be made more general and perfect, even in long wall mines, than it is at present. The importance of this portion of coal mining being done well we can all well understand, when we remember that the existing drain upon the lives of our colliers cannot be traced to explosions, for the heaviest item is due to falls of the roof.

In 1868 and 1869 the deaths by explosions in the British coal fields amounted to 411, whilst by fall of the roof we find 911, or more than double. The public take but little heed of the latter, because of the comparative smallness of the event where a fall of roof is recorded, and one or two lives only lost, but they do take heed of explosions, on account of the disastrous consequences which usually follow, although in themselves of rare occurrence; but the colliery manager, who has an eye to a good balance at the end of the year, knows the ultimate cost of these frequently occurring accidents, which only take one or two lives at a time, but justify the writer in making rather more than a passing reference to.

Associated with the miner's duties just referred to, comes the use of gunpowder in collieries, which, like the packing and timbering, should devolve upon one man skilled in the use of the same, and a close observer of the presence of the smallest portion of gas, for when the miner has this dangerous weapon, gunpowder, in his own hands he is tempted to use too great a quantity than is absolutely necessary to separate the mass of coal worked upon from the solid, instead of bringing it down with as little fall as possible, and so, while protecting himself, avoid the possibility of disturbing the ordinary ventilation of the mine.

This rule would, I think, help to produce a greater immunity from explosions of gas, for most of the explosions are traced to the incautious practice of firing shots in the neighbourhood of accumulations of gas, hence the importance of this duty being attended to by an intelligent workman, and it can be practically carried out the most effectually under the necessary discipline of long wall than by any other method.

The writer is of opinion that the extension of this system of long wall in coal mining is the pioneer paving the way for the working of this mineral at greater depths than we are accustomed to at present, for under no system of pillar workings could we get adequate ventilation at such depths as necessity will compel those following after us to venture to; for when we come to work at depths of 1200 yards and upwards we shall strive to convey all the air we can collect direct to the working faces unimpaired, avoiding all circuitous air-courses, which would so diminish as to render the ventilation totally inadequate. Associated with this portion of my subject, I may state that the deepest mines in existence, where we may collect evidence as to the temperature under the above circumstances, are Rosebridge Colliery, in Lancashire, 806 yards deep, the normal temperature of the coal at that depth being 93·5, while the temperature of the air passing through the workings is 78. At Denaby Main Colliery, the deepest and nearest mine to Doncaster, the temperature of the air passing through the workings averages about 68.

In Belgium coal mining has descended to a depth of nearly 1200 yards, from which data, and other experiments made at depths of 500 yards and upwards, which I must admit have varied very considerably, there is an indicated increase of temperature of about 1° for every 76 ft. at high elevations above the level of the sea; of course at places considerably below the level of the sea the ratio would be increased. At the same time, in working coal at great depths it is not at all improbable that this temperature may be considerably reduced by natural causes, such as the evaporation of water passing through the overlying strata, combined with the most perfect mechanical and general arrangement of ventilation.

This subject of the ratio of increase of temperature of coal mines at increased depths bears a most important and interesting part in the economy of our coal fields in the future, and as it is one that chemists and engineers have somewhat investigated of late, I hope some member of this society will contribute a paper on that subject.

There is another insuperable barrier of the pillar workings at increased depths, in addition to the ventilating difficulty just referred to—the pressure of the superincumbent strata upon such pillars of coal, which will necessarily increase the deeper we go. At the same time, in investigating this subject, we cannot draw an infallible rule for the rate of increase, which is regulated a little by the material passed through; for instance, if the sinkings pass through any rocks of great thickness and extent, the pressure might be somewhat relieved thereby. A cubic foot of rock sand weighs 156 lbs., of shale or bind 160 lbs., and of coal 82 lbs. Mr. Fowler calculates—

"That the average weight of these in different localities may be taken at 144 lbs. per cubic foot of the coal measures, which represents a pressure of 1 lb. per square inch for each vertical foot of strata; a coal seam, therefore, 1000 ft. deep will have a dead loading of 4000 lbs. per square inch upon it as it lies untouched."

I think these calculations as near as it is possible to arrive at, not forgetting that there would be an increased local pressure, varying according to the system of coal mining employed; it would, therefore, be impossible to preserve any pillars of coal, however large they might be, if once disturbed; and even if it were possible to get such pillars it would only be at a loss, hence long wall suggests the removing of this pressure from the coal, on to a well-constructed artificial goaf, built as the workings proceed.

The writer is convinced that long wall will pave the way for a revolution in the detail of coal mining, which must come sooner or later—the extensive use of machinery in coal getting. The public have before them at the present time a great variety of inventions, aiming to do so successfully; some arranged for baring and some for breaking down the coal, and some to do both operations. The motive-power employed is often hydraulic, and in some instances compressed air.

Mr. Grafton Jones's breaking-down machine, and the machines of the West Ardsley Coal Company, are the most successful representations of such machines that have appeared up to the present time. These machines in time, as the practical application of them becomes better understood, will surely, however slowly, ripen to perfection, and not any system of getting coal is so peculiarly favourable (nay, I may venture to add absolutely necessary) to the economical adoption of machinery as that of long wall, by reason of the long continuous face of coal always open, to which there will always be a direct highway from the pit bottom. For the easy conveyance of compressed air, or any other motive-power employed, the use of machinery will rather tend to increase the amount of ventilation than otherwise.

I now come to the net results obtained by the extension of this system of coal mining by long wall or end, which the writer believes to consist of the following:—

1.—Economy in its results to the proprietor from the increased market value of the product obtained, and the soonest return for his invested capital.

2.—Economical ventilation, and increased safety to the miner.

3.—Simplicity and less liability to accidents.

4.—An increased quantity of useful coal from the same area. This is the natural gain all desire, and which the writer believes will be best obtained by the diffusion of improved mining knowledge concerning such system, rather than by legislative interference.

To our local friends in the neighbourhood of Doncaster the economical working of our coal fields is a matter of great interest, standing, as at present we do, upon those coal measures underlying the Permian rocks, a section of which I have added to my illustrations, calculated from what I consider the most reliable data. Their value and extent may be estimated by one fact—that in this section are represented all the seams belonging to the Yorkshire coal field, numbering nearly 40, with an aggregate thickness of nearly 90 ft., at least 30 ft. of which will be workable, sooner or later, in this district. Those seams underlying the Permian formation, already worked, I have distinguished on my section, and also added the locality where such collieries are situated.

The above rocks will have to contribute the coal fields of future generations. At the same time, situated as the *upper* portion of this coal field is, within a reasonable depth, I do not see any reason why it should not contribute its share to the requirements of the present century. I must express my astonishment that it has not already been developed, and thus locally derive the advantage of the excellent colliery sites which are to be found in the vicinity of Doncaster; and my own opinion has been confirmed by a friend of mine, of great commercial experience in the coal trade, that Doncaster is unequalled in its geographical position by any colliery district in the kingdom. With a willing and liberal proprietary, I think it possible that enterprising capitalists can be found to develope such vast resources.

With regard to the lower or deeper portion of our coal fields, the longer they are left untouched the better it will be for us, for increased depth in working coal will involve increased outlay in mining the same, which will result in increased cost to the consumer.

Interesting as the study is of the exhaustion and probable duration of our coal fields, yet, as it is an unavoidable consequence of a great consumption, we cannot help its gradual exhaustion. Let us, then, look more rigidly after what is left, and so tide off to the latest possible period the exhaustion of a mineral so essential to our existence as a great and flourishing people, for should we ever be dependent upon importation for our supply I think that the evil day which was predicted by Mr. Stanley Jevons, in his exceedingly clever argument, will have arrived when England will have to give way in its manufactures and commerce to some country whose mineral resource have been but little broken into. At the same time, it is not at all improbable, when we think of what an age of discovery we now live in, and the increased light that a future generation may possess, that the use of coal may be superseded altogether by some discovery in chemical science.

* Concluded from the Supplement to last week's Journal. Read at the Geological and Polytechnic Society of the West Riding of Yorkshire. Illustrated with numerous diagrams.

ON THE MATRIX OF THE GOLD IN THE SCOTTISH GOLD FIELDS.—Dr. BRYCE read a paper on this subject at the British Association. Up to July last year the source of the gold of the alluvial workings in Sutherland had not been determined. Many of the miners had been at other diggings, where the gold occurred in quartz reefs, and, accordingly, their search was constantly directed to the discovery of such reefs, but without success. The author had directed his attention to the elucidation of this point, and had found that the banks of the Sinsgill burn consisted of alternating coarse whitish granite and a highly crystalline mica slate. On crushing the granite and washing the sand grains of gold were found in every specimen. A similar result was obtained by crushing and washing specimens of the mica slate, but the gold was less abundant, and was absent from several specimens. Early in the last winter gold grains were found in considerable quantity in the alluvia of the Errick and Nairn rivers towards their mouths, and were soon after detected at various points far up the channels of these streams. The author had examined the upper valleys of these streams, and found them to consist of granite and metamorphic slates, and in this granite gold was found in considerable quantities.

ON THE SOUTH-AFRICAN GOLD FIELDS.—Sir JOHN SWINBURNE, Bart., read a paper on this subject at the British Association. The part of South Africa treated of by the author was the district lying between the Limpopo and the Zambesi rivers, and between 27° E. long. and the Indian Ocean. The shortest practicable route to it is by way of Port Natal and Harrismith. There is no public conveyance between Maritzburg and Harrismith, a distance of 150 miles, and the road is very bad, as all the rivers and valleys are crossed at right angles. The Drakensberg is crossed on the road at an altitude of 5400 feet. From Harrismith to Potchefstroom, a distance of 190 miles, the country is undulating, and almost destitute of wood: 75 miles further Rustenburg is reached, the last civilised place in the interior; hence to the Tati river is a march of 382 miles through the bush country, a monotonous, arid tract, wooded with stunted trees, rarely exceeding 60 ft. in height. The mining settlement on the Tati is situated in lat. 21° 27′ S. and 27° 40′ E. long., at an elevation of 3200 feet above the sea. The southern gold fields, as far as the actual metal has been found, extends from N.W. to S.E., a distance of 40 miles by 14 miles broad. There are five different mines within a mile of the settlement; two 3 miles to the south-east, one 13 miles north; two 12 miles and one 35 miles up the river to the north-west of the settlement: making a total of eleven mines which have actually been worked and gold extracted. Besides these there are numerous other reefs where gold has been discovered, but these have not yet been worked. In most of the mines two shafts have been sunk to an average depth of 50 feet, and all are upon the site of ancient workings. The original miners appear to have worked the reefs more in the manner of quarries than mines, leaving great holes or pits. There are two descriptions of quartz, one red and honeycombed, the other of a bluishgrey appearances, the gold in the latter being coarser, but more easily discriminated, than in the red ore. The climate of the gold country is very healthy. From the end of April to October no rain falls; the other months are subject to violent thunder-storms, but there is scarcely a day without some hours of fine weather; the nights are always cold, in June the thermometer falling as low as 38° Fahr. about one hour before sunrise, while it ranges as high as 88° or 90° during the day. The prevailing wind for nine months of the year is S.E., blowing strong during the day, and dying away at sunset. The northern gold fields lie 327 miles to the N.N.E. of the Tati, in the Zambesi basin, their northern part being the Umfuli river (the Tole or Banyeka of Livingstone's map), and their southern boundary the Bembees. The latitude of the principal workings is 18° 11′ S., and the longitude 30° 34′ E., and they are distant 205 miles from Tete, and 160 miles due south of Zumbo, on the Zambesi; at present they have not been very productive. The country is densely peopled by the Meshuna nation, industrious workers in iron and earthenware, and growing all kinds of grain and pulse. The author, who visited these previously almost unknown people, gave a sketch of their recent dealings with the invading Matabele Caffres.

THE DIAMOND FIELDS OF SOUTH AFRICA.

BY HENRY HALL, F.R.G.S.

North and north-east of the Cape Colony exist vast rolling plains, forming a plateau, or table-land, of an average height of 4000 feet above the sea, studded over with innumerable detached kopjies, pointed or flat-topped hills of moderate elevation (spitz-kopjies or tafelbergen), which gradually decrease as we approach the Vaal River, of basaltic or green porphyritic rock, protruded as it were through the more recent sandstone or conglomerates of the lacustrine formation, which cover the whole region in almost horizontal layers. These plains are fringed round from the north-east to the south-east, an extent of many hundred miles, by high, and on one side, precipitous mountain ranges. The Plombergen, Maluti, Quathlamba, Drachenberg, and Magaliesbergen, varying in height from 5000 to 10,000 ft., which, forming the watershed of two different branches of the Gariep or Orange River and its tributaries, the Vaal, Caledon, Hart, and Modder rivers, rise in escarped faces on the coast side like gigantic buttresses supporting these lofty plains, and separating them from the lower terraces of the Cape Colony, Kaffaria, Natal, and Zululand. It is not more than half a century ago since these regions attracted the attention of the Cape colonists, first as the scene of the murderous forays of the Zulu tyrants, Chaka, Moselikatze, and Dingaan, whose warriors almost extirpated the more peaceable Betjimana tribes who inhabitated the land, and the remnant of whom, forming the Abasutu tribes of Mocheshi, took refuge in the inaccessible valleys of the Maluti mountains, where they still preserve their independence; and more recently as a vast hunting field, first described by Captain Harris, in 1836, as teeming with elephants, rhinoceri, giraffes, and all the larger species of antilopes—the former quite, the latter nearly extirpated.

Then, in a political point of view, came the exodus of the Cape Boers from that colony, and their settlement on the Orange River plains and Natal; the wars consequent thereon; the final withdrawal of the British rule, which, in the first instance, had been extended to this region; and the establishment of the two South African Republics, the one north of the Vaal River called the Trans-Vaal, and the other in the region between the Vaal and Cape frontier, which in that direction is the Gariep or Orange River, called the Orange River Free State. Two listless communities, devoid of any seaboard or port, with the inhabitants leading a life without excitement, vegetating rather than living on the vast extent of monstrous treeless plains of 10,000 or 15,000 acres each, called "places" or farms, although in Europe they would be called estates; wandering about with their sheep and cattle from one green spot of pasture to another, being much in the style of the ancient Patriarchs, in a very similar region between Palestine and the Euphrates; while the customs dues on all the articles of foreign produce they consume go to swell the exchequer of the British colonies of the Cape and Natal, in whose harbours they are landed.

Events, however, have been lately occurring on these plains, and along the banks of the many rivers, or rather watercourses, which intersect them, and which run but for a few months of the year, but which, after heavy rains or thunderstorms along the tempest-riven peaks of the Drachenberg and Maluti ranges, pour down perfect avalanches of debris, composed of gravel, pebbles, and other alluvial deposits into the turbid waters of the Vaal or Yellow River, the Modder or Muddy River, and the Gariep, Orange, or Great Black River, and which in the dry season, when the soluble matter has been washed away and deposited in the shape of mud on the banks, exhibits, on the shoals and shallows of the stream, beds of pebbles containing agates, camelians, jaspers, in great variety, and well known to collectors of mineralogical specimens at the Cape as "Orange River pebbles." These pebbles are often curious and beautiful, and contain many rare specimens if examined by an expert; but they are too numerous to be deemed of any value, and are principally regarded fit for chimney ornaments, card-counters, and such trivial purposes, and few go to the expense of preparing them under the hands of a lapidary, so as to properly develope the beauties they really possess. As early as 1819 the missionary Campbell, who first explored the course of the Orange River, from its junction with the Vaal, in lat. 29° 20′ S., and lon. 23° 30′ E., to its embouchure on the west coast, describes a portion of the region he passed through as covered with pure crystal pebbles, sparkling in the distance like diamonds, and many other travellers mentioned the agates, jaspers, camelians, of the Orange River countries, supposing them to be the products of the disintegrating peaks of the surrounding mountain ranges.

The geology of South Africa rests on such imperfect data, and the extent of the penetration of basaltic or porphyritic rocks is so roughly defined, that we can here give but an imperfect theory of the region in which the diamond discoveries have taken place. These plains, it is supposed, have been formerly the bed of a vast freshwater sea or lake. Many miles down the Orange River, towards the ocean, violent volcanic action has, at a remote period, taken place, forming the great falls of "Aukrubies," 150 ft. in height, and so creating an outlet for the inland waters. Denudations seem, consequently, to have occurred to a great extent, and various little kopjies or hillocks of diluvial matter, composed of quartz, agate pebbles, jaspers, and appearing as if deposited by eddies or whirlpools, occur on both sides and in the neighbourhood of the water-courses; and on these little hills the clearest testimony shows diamonds have been recently discovered, in conjunction with conglomerate masses, cemented together with oxide of iron, tufaceous limestone, and other similar rock-forming substances.

The writer of this article lived for many years in South Africa, and is familiar with the localities in which diamonds have been found; but he never recollects a hint being given during that period that

such treasures really existed, although he has heard of, and seen, small rubies, sapphires, and amethysts, but of such a size as to be nearly valueless. It is now four years ago since the first diamond was discovered and sent to Cape Town. There is a few miles south of the Orange River, near the northern boundary of the Cape Colony, and about 600 miles north-east of Cape Town, an obscure village, or seat of magistracy, called Hope Town, where the seat of the local Government for an extensive tract of a thinly-inhabited country being fixed, a church being founded, and possessing good water advantages, a cluster of houses, shops, and stores, for the supply of the neighbouring farms, sprung up, and from this Hope Town the first rumour of the diamond-bearing region along the banks of the Vaal and Orange rivers reached the ears of the commercial community at Port Elizabeth and Cape Town. A very fine diamond of the first water, valued at 500*l.*, fell into the hands of a trader there, who purchased it for a trifle from a native, amongst whose children it had passed for a plaything, paying for it, we imagine, a few sheep, cattle, or a wagon, which to a native is a fortune in itself. Many more of these shining stones (even uncut diamond shine amongt their quartz companions) by degrees found their way into the hands of the little Hope Town winklers, as retail dealers are called in the Cape patois.

These discoveries were hinted abroad, and at last reached the ears of a celebrated firm of London diamond merchants, who sent a trusted agent out to make enquiries. Like almost every European geologists, who for the first time visit the lacustrine deposits of South Africa, he made a most egregious mistake, and declared the supposed find of diamonds must have been what is called in slang language a "plant" made by some land speculator who wanted to dispose of his farms, but that in a geological point of view it was impossible that diamond beds could exist in that region. He might perhaps be strictly right, but he appears to have entirely overlooked the vast physical forces that carried and deposited them there. The same earth-throe that formed the Zambesi Falls of Livingstone, having probably at the same time made those of the Orange River, and draining the inland sea, covered the plains of the Vaal River with the diamond debris of the disintegrated peaks of the Maluti mountains.

Time went on, the public were still incredulous, but by degrees one diamond, then half-a-dozen or more rough and uncut were offered for sale in the Port Elizabeth markets. The Governor, Sir P. Wodehouse, was known to have purchased several, and the house of Mosenthal and Co., a Cape commercial firm of repute, were reported also to have invested largely though quietly in the same speculation; but it was not until the close of the second year, 1868, that the colonial world was startled by the announcement that a diamond of pure water had been picked up, weighing 83½ carats. There is some obscurity about where it was found and by whom, but it eventually came from the hands of the native finders and intermediate traffickers, into those of Messrs. Mosenthal, for a considerable sum; was deposited for some time in the hands of the Cape Government, and eventually sent to Europe in the spring of 1869, under the name of the Star of South Africa. It remained in London some time, was cut in Amsterdam, and although considerably reduced in weight, turned out a splendid brilliant, and was sold for a considerable sum —14,000*l.* we are informed, some say 24,000*l.* After the discovery of the Star of South Africa, a regular *furore* sprung up for diamond digging, and thousands of the already sparse population of the Cape Colony and Free State are still flocking to the banks of the Vaal River, where, near the Mission Station Pniel on the south, and Hebron on the north side of the river, the principal finds have as yet been made of diamonds of all sizes, from 1 to 50 carats, besides a considerable quantity of the valuable, though inferior, diamond "Bort," used for cutting and polishing purposes. Although the appliances used are of the most make-shift nature, and the majority of the diggers totally inexperienced—few of them, probably, ever having seen a rough diamond before in their lives—within the last few months diamonds to the value of 100,000*l.*, very lowly estimated, have already been found, being an average of an earning of about 15s. a day for all those employed, now about 3000, many of whom, however, have been as yet unsuccessful.

The romantic stories in the Cape papers, though not altogether devoid of truth, must, however, be taken *cum grano salis.* Many a digger may believe himself in possession of a real gem worth many thousand pounds which may turn out a worthless quartz pebble, while, on the other hand, in every shovelful of gravel hundreds of small diamonds, all of some value, may exist, and may be thrown aside, owing to the perfect inexperience of the "diamantzockers," as the Dutch boers call the diggers. In the meantime the value of landed property and produce of every kind in this once desolate region has marvellously increased. The President Pretorious, of the Trans-Vaal Republic, has laid down his baton of office, taken up pickaxe and shovel, and enrolled himself amongst the band of diggers, with all his officials with him. We find in the list of diamond seekers clergymen, medicos, Government clerks, and officials of high degree, farmers, officers of the army, two of whom, from Natal, it is said, have realised 15,000*l.* in a few weeks. A sort of provisional Government has been formed, and order and regularity exist to a wonderful degree; nor are the *agremens* of life altogether wanted, as we find at the diggings billiard tables, Christy minstrels, soda-water machines, &c.

We must not be surprised, however, to find many, both diamond seekers and buyers, disappointed, as in our judgment the prices said to be given for uncut diamonds at the diggings are far more than cut stones could be purchased for in London, Paris, or Amsterdam. Pniel and Hebron, where the principal explorations are going on, are stations of the Berlin Mission Society, near the great band of the Vaal River. The missionaries very injudiciously levy a tribute on all diggers of 25 per cent. on the value of the diamonds they find, instead of demanding a moderate sum for a licence for digging; this causes much concealment of diamonds found on the digger's part. In a similar manner these worthies taxed heavily a few years ago parties seeking copper mines in Namaqualand, making the infliction worse by declaring it was for the "sake of the Lord." In the latter case it was also the Berlin or Rhenish Societies who profited, while their titles to the soil were in many cases anything but indisputable. The Pniel and Hebron diamond fields are about 800 miles from Cape Town, *via* Beaufort West, and 650 from Port Elizabeth, *via* Colesberg. The roads are in general good, and the use of bullock wagons enables parties of diggers to carry the necessary supplies with them, which on the spot would prove very expensive.

The following extracts from the correspondence of many respectable and trustworthy persons who have visited the diamond region may prove interesting. Mr. Cooper, of Cradock, writes to Dr. Grey, of the same place:—"The position in which the diamonds are found is a complete enigma to me. The richest find has been on the top of a 'kopje,' perhaps 100 feet above the river. Indeed, the present run of the river has nothing to do with the find of the diamonds. The whole country must have been submerged, and the matrix in which the diamonds are found must have been deposited in the run of the inundation, current, lake, or body of water. The matrix is found upon and between the chinks of the rocks. The surface is strewn with fragments of rocks and metamorphic sandstone, I think pudding-stone, quartz, and also ironstone. I do not think any of these rocks are abrased by friction; their edges are more or less rounded off, but this arises, I think, from decomposition. Diamonds continue to be found daily; yesterday a 29½ carat, and the day before a 17½ carat, besides many smaller." Another correspondent says:—"In regard to the constituent stones of good diamondiferous gravel, satisfactory information cannot be got. Some diggers prefer a light coloured and sparkling gravel, others again are in favour of a dark coloured pebby soil. Rotten ironstone or basalt pebbles are considered a favourable sign; gravel with quartz fragments, not water, more the contrary. For many reasons I am inclined to think the best indications are garnets (spinel rubies), and peridot, a blue transparent crystal."

Another writer, Mr. Gillfillan, late of the Royal School of Mines, in an interesting letter to the Editor of the *Grahamstown Journal*, mentions:—"Undoubted diamonds deposited here (junction of Vaal and Modder rivers), conglomerate and yellow schist, pebbles of black and red jasper in highly ferruginous soil, stratification of rocks horizontal. All the pebbles and crystals in this ferruginous soil are coated with a thin deposit of oxide of iron. I examined a stone in the possession of a Hottentot, about 3 carats, a rhombic dodecahedron; owner refused to sell. It was of first-rate water, but specked and flawed; value about 30*l.*" As the diggings are developed, he will perhaps be able to add a second part to the present article, as it is highly probable owing to the volcanic disturbances in the lower course of the Orange River, and the metalliferous region of Namaqualand traversed by it, that mineralogical discoveries will be made there which may turn out of the first importance.

DIAMONDS, AND DIAMOND SEEKING.

The recent discovery of diamond districts in South Africa has naturally led to many enquiries as to the mode of seeking pursued in countries where, from the existence of diamonds having long been known, valuable experience is likely to have been gained; but the amount of information obtainable upon the subject is extremely limited, chiefly because the success of the operator depends almost entirely upon the quickness of sight, and not upon skilful manipulation. There is usually little difficulty in distinguishing a diamond from another stone, even by its high refractive power and general appearance, and as its hardness is 10 a very rough test of this will suffice to remove all doubt. The most valued stones are colourless, but brownish tints in them are very common, and those of green, yellow, red, blue, &c., are also met with; the colouring, however, being generally so slight as merely to put the stone "off colour," and thus lessen its commercial value. When the colour is decided, as in Mr. Hope's blue diamond for example, the stone is almost as highly prized as though it were colourless. Chemically, the diamond is pure carbon, and in this respect the difference between diamond and graphite (which is scarcely more valuable than coal) is extremely small, the presence of slight impurities, such as iron, lime, alumina, &c., being all that distinguishes them.

Whatever may have been the abundance of diamonds in the mountains of Golconda in Marco Polo's time, when it was said to suffice to throw pieces of flesh to the eagles and storks in the valleys, and then pursue them to their haunts at the top of the rocks, in order to collect the diamonds found sticking to the meat, it is certain that at present the process of washing for diamonds is like seeking for a needle in a bottle of hay—slow and laborious. Hitherto the principal diamond districts have been those of India and Brazil, although diamond fields have also been met with in many of the islands of the Eastern archipelago and in Australia, Algiers, Russia, and America. The South Africans now claim to have their country added to the list, and, although it is beyond question that the accounts of the extent of the discoveries has been much exaggerated, no doubt is entertained that diamonds are really found there. The process, known in this country most closely allied to diamond seeking is tin-streaming, yet there is the important difference that whilst in streaming for tin the difference of specific gravity between the valuable and the worthless material can be turned to account in effecting the separation, the specific gravity of the diamond is so nearly the same as that of the gravel with which it is found that dependence has to be placed upon the eye alone.

The history of the celebrated diamonds—the Mattan, the Koh-i-noor, the Russian, the Austrian, the Pitt, and others—is alone of considerable interest, but until we can add the great Hottentot diamond to the list the South Africans will probably regard an account of the mode of collecting diamonds as of much greater importance. Previously to 1730 India, and chiefly the diamond field of Golconda, was almost the sole source of supply; but in that year an officer who had spent some years in the East Indies, sent to a friend in Lisbon a handful of pebbles, which proved to be diamonds of the finest quality. The history of these pebbles is not without interest; they were found by some miners searching for gold, and carried home to their masters as curiosities. Their nature and value not being known they were given to the children to play with, and no further importance was attached to them until they were seen by the officer, as mentioned, and forwarded to Europe, where both in Portugal and Holland they were at once recognised.

Diamond working in Brazil is an extremely simple operation. At the season when the river waters are low the negroes dredge up mud from the bed of the stream, and remove it to the dressing-huts for subsequent treatment. These sheds are usually about 50 ft. wide, and twice or thrice that length, and are in the immediate vicinity of a launder or canal, constructed for the purpose of conveying water to the hutches beside it. A plank flooring 5 or 6 yards wide is laid at a slight inclination from the canal, and divided into a series of troughs about 2 ft. wide. A portion of the mud having to be thrown into the trough, water is let in, and the whole stirred with a rake until the earthy matter has been washed away, and the water is left clear.

The remaining gravel is now raked up to one end, and the stones thrown out by hand, the largest first. The negro thus examines every pebble, and when he finds a diamond he claps his hands and holds it in his thumb and finger above his head. The diamond is taken from him by an overseer, who is constantly watching, and the work proceeds as before. The find is carefully registered at the end of the day by the head overseer. Various rewards to encourage diligent searching are given to the negroes in proportion to the value of the stones found, the most coveted prize being reserved for those who are fortunate to find a stone of more than 15 carats; for this he at once becomes a free man. Carefully as the watching is conducted, it is estimated that at least one-half of the diamonds found are stolen by those employed.

In the case of diamond fields in South Africa, both time and labour, as well as water, which is often an important item, could, no doubt, be saved by the adoption of some of the jigging and dressing machinery employed in connection with metalliferous mining, both in the old world and the new. In Australia Hunt's jigging-hutch has been employed with much advantage, but the fact must never be lost sight of that it is almost entirely upon the vigilance of examining every stone and pebble that success depends.

WASTE OF FUEL.

Mr. T. W. Lewis, President of the South Wales Institute of Engineers, in his address at a recent meeting, said:—It appears to me that a very great saving is to be effected by a little more attention to the construction of our boilers, the amount of boiler power, provision for heating the water, preventing the radiation and loss of heat, the general arrangements in the every-day practice of our mechanical engineers. The quantity of fuel that has been wasted in the South Wales district is perfectly astounding; and I am sure if I were to give figures they would not be credited. It no doubt arose to a very great extent from the abundance and cheapness of the coal, for while large coal was being consumed here, regardless of quantity, and without any effort made to preserve and utilise the heat obtained, other manufacturing districts, not blessed with fuel under their feet, were (in consequence of its comparatively high price) obliged to devise means for obtaining two and three times the work out of every ton of coal that we did here, and also to consume their small coal and utilise gases for heating. Keen competition, and the low price of iron, however, forced our ironmasters to the use of their waste gases, hot-blast, and small coal in the manufacture of iron, and thus effect a very great saving in fuel; but there is still very much to be done in reducing the quantity of fuel wasted in the getting up of steam, and in preserving the power when once obtained. Great economy might be realised, even with our present system, by increased boiler power, improved draught, so as to consume small coal and refuse, the heating of the feed water by the exhaust steam and the waste heat on its way to the stack, the effectual covering of all the boilers, steam-pipes, cylinders, &c.; but we should not rest satisfied until we have a much more perfect form of boiler, whereby only about 1½ lb. to 2 lbs. of coal per horse-power per hour would be consumed. Even the arrangements common in this district may, by a comparatively small cost, be improved so as to reduce the consumption of coal one-half. There are several places within my own knowledge where, by improvements such as I have sketched out, the consumption of fuel is now 50 per cent. less than it was formerly, and small coal is used instead of large.

The matter is one of national importance, inasmuch as we are wasting 50 per cent. of the very material which has really been the means of making this country the seat of manufacture for the greater portion of the world, and of now holding its own with the manufacturing centres on the Continent; but to us engaged in the getting, using, and disposing of the coal it must present itself most forcibly, with the constantly increasing tendency to run up the cost of getting coal in this district. Even if a saving of 25 per cent. could be effected in the coal consumed for steam purposes in the South Wales mineral basin alone, the value of it per annum would represent above 105,000*l.* The consumption, per horse-power per hour, even then would be far in excess of some of the improved engines and boilers now used in districts where fuel costs twice or thrice what it does here. In fact, there are some engine and boiler makers that now guarantee their engines and boilers not to consume more than 1½ lb. per horse-power per hour, while a great many of our engines in this district consume 8 lbs. to 10 lbs. per horse-power per hour. With these facts before us, although the contrast may to some extent be modified, according to circumstances, I hardly need dwell upon the desirability of the institute again taking into consideration, and thoroughly investigating, this important question of the most economical mode of using our fuel. Another subject, closely allied to the use of fuel, is that of the large proportion of coal lost in working, and left underground, upon which a paper was read before this institute in the year 1861. Although very great improvement has taken place in a portion of the South Wales mineral basin in this respect since the introduction of the long wall system (which I may here mention owes its general adoption in this district to the papers and discussions of this institute, and for which all interested in the minerals, both as landlords and tenants, are much indebted), still a very large proportion of coal is left underground, amounting to an average of at least 18 per cent. This is, again, a very serious loss, and deserves most careful attention.

PURIFYING IRON AND MAKING STEEL FROM COMMON ENGLISH IRON—THE SHERMAN PROCESS.

In the report of the Iron Trade of North and South Staffordshire, in last week's *Mining Journal*, notice has been taken of the Sherman Process for improving iron and manufacturing steel from English iron. The process is said to be "just now creating some attention here, although it is the general opinion of practical men that it can only succeed in pre-arranged experiments." Another gentleman, who was present at the Quarterly Meeting at Birmingham, and was an attentive observer of Mr. SHERMAN'S exhibition of the samples of iron and steel made by his process, and the manner of its reception by practical men in the iron and steel business, writes that he came to a very different conclusion. The Quarterly Meeting was held in the Town Hall in Birmingham, the floor of which was well filled by men in the iron and steel business from all parts of the country. At that meeting Mr. SHERMAN had spread over a table about 12 feet long some fifty specimens of iron, and different tempers of steel, made by his process from a poor quality of pig-iron.

There were samples of puddled bar, made from a low grade of pig without mixture, pronounced of excellent quality, and bars of the same re-heated and rolled equal to "best best" charcoal iron, and good quality of tool and other steel made from the same iron. The discovery of any means that will produce results of such vast importance to the iron interests, and to the country generally, should be met and investigated in a spirit of fairness and candour, and not prejudged and condemned because all past efforts have failed to produce like results. The application of such logic would be a fatal barrier to any further discovery in a direction where further discovery and invention are so much needed, and have been looked and waited for with such impatient interest for nearly the last half-century.

It would not be at all strange if a discovery so simple in its application, involving no additional outlay for its continued application, so invaluable and marvellous in its effects, and which has heretofore been sought for in vain, should be looked upon with some doubt, and received with hesitation, by persons who have had no explanations, and no other knowledge on the subject, except such as they obtained from a view of the samples before them. And yet from the earnestness which we observed, and learned that "practical men" took in the subject, and who listened to the explanations of Messrs. SHERMAN and MAINWARING, manager at the Darlaston Works, who volunteered to assist him, and from the many invitations which Mr. SHERMAN has received to visit leading iron works in different parts of the country, and apply his process in them, it is at least only fair to infer that he made a very favourable impression on the minds of practical men, and that they are not only ready but anxious to give his process a fair trial and chance of success. Mr. SHERMAN has been very quietly making trials of his process at different works in this country for over three months, and in no case has there been any pre-arrangement, and every trial was attended with the most complete success.

When he visited works for the purpose of illustrating his process he generally requested, when treating iron in puddling-furnaces, that the poorest pig they had at command should be made use of. The iron he had never seen before, and knew absolutely nothing of its peculiarities or chemical combinations from analyses or critical examinations. He knows very well that the greatest enemies of iron are silicon, sulphur, and phosphorus, and that by his process he can eliminate them, and leave the iron in a comparatively pure state; and by a second treatment, applied in crucible furnaces, he can make of the iron thus made of poor pig tool and other qualities of steel equal to any made of best Swedish iron, and in some respects superior, for it is stronger and more ductile, and possesses greater ductility and tensile strength combined than any other steel now made.

Mr. SHERMAN is no adventurer, who has come to England to sell an undeveloped and unperfected invention or discovery. He is here by invitation of Her Majesty's Government, and has been most cordially received by that Government. The invitation was sent to him by the late Earl CLARENDON, on a knowledge of the merits of his process, and the great value it would be to this country, where nearly one-half the iron and steel of the known world is produced, and where the iron generally is of so poor a quality, and there is so much need of improvement. There will be not far from 6,000,000 tons of pig-iron made in the United Kingdom during the present year. Probably from 3,000,000 to 4,000,000 tons of this amount will be worked into finished iron. Now, if this can all, at a very moderate cost per ton, be so improved as to be, at least, equal to "best best" charcoal iron, all must see the very great value it will be to the iron and other interests of the country. It must add millions on millions to that value; the approximate amount I leave men skilled in such details to calculate. The way to effect such an improvement Mr. SHERMAN claims to have discovered, and, so far as I can judge from observing repeated trials on both iron and steel, he has accomplished this long-desired result. He claims to have accomplished even more than this, and that by purifying the iron both the iron and steel made by his process are stronger and more ductile than they would otherwise be. In proof of this he offers various illustrations. On his arrival in this country he was requested by the Admiralty to furnish samples of steel made by his process of English iron. He complied with this request, and at various times made at one of the first steel works in Sheffield tool, die, and other qualities of steel, sometimes of BESSEMER scrap, though generally of common English iron. These steels were carefully tested by Government officers at one of the Government dock yards, and showed an excellence for turning and other tools, and for all purposes where great ductility and strength are required, rarely reached, and never surpassed.

Steel of the same grade showed great uniformity and tensile strength, that suitable for tools running from about 70 to over 76 tons to the square inch, and an elongation of 11-16ths of an inch in 6 inches. At the request of the Commissioners of the Admiralty he applied his process in the manufacture of cast-steel ship-plates. These plates were made of common English iron, in Sheffield. The iron of which they were made was examined and, it is believed, selected by Mr. LUKE, Chief Surveyor to the Admiralty, who watched the progress of the manufacture, put his stamp on the plates, and sent them to Chatham Dockyard to be tested, under the supervision of Government officers. These plates were 7-16ths of an inch thick, and the Government requirement is that steel plates of this thickness should be of such ductility as to bend *cold* to an angle of 75° with the grain without fracture, and 50° across the grain. The ductility of these steel plates, made by the SHERMAN process, was so great that they were bent double *cold*, or to an angle of 180° with the grain, in all the sam-

ples examined, without the least sign of fracture; and to the same angle across the grain, with very slight fracture. These plates show a degree of ductility, strength, and uniformity in texture never before approached by steel plates. These heretofore unattained qualities in steel plates make the SHERMAN process peculiarly valuable for ship and boiler-plates, in either iron or steel, because sufficient ductility and uniformity for safety has not before been gained. The cause of weakness, and therefore insecurity, in both iron and steel is the want of ductility, strength, and uniformity, occasioned by impurities in the iron, and which also remain in the steel, causing either metal to give way at points where these impurities are most concentrated. Any discoveries which will to a great extent, or entirely, remove the causes of weakness, and leave the metals comparatively pure, and therefore reliable and safe for all purposes, whether in the construction of ships, machinery, bridges, buildings, or to whatever purpose they may be applied, are invaluable, and will hereafter be recorded among the great discoveries of modern times. I may state here that elaborate official reports were drawn up on these Government tests by officers of the Admiralty, and the Government stamp put on all the metals tested, which has given them an indisputable claim to reliability.

After completing the engagements he then had with the Admiralty, and, it is understood, completely satisfying them of the great value of his discovery, he continued at other works the application of his process in the manufacture of both iron and steel, his object being, after having received the approval of the Admiralty, to conduct a series of trials in the manufacture of iron at some works of good standing, where he would be met without prejudice. This he has done principally at the Darlaston Steel and Iron Works, near Wednesbury, South Staffordshire. He had no voice in the selection of the iron he was to treat, except to request them to give him the poorest they had, and not to mix it, but charge the furnaces entirely with the same brand, and a low grade of pig-iron, costing about 3*l.* per ton, delivered in the yard at the works, was selected by the manager, and for some days the puddling was done in two furnaces, under the observation of the manager. Every heat proved a complete success, and made good strong puddled-bars, fit, it was said, to be worked into finished iron, for any purpose. Several of these bars were cut up and melted in crucible furnaces, and by a second treatment steel of an excellent quality for tools and other uses was produced. Chisels, cold sets, and tools for turning chilled rolls, were made in the smith's shop at the Darlaston Works, of this steel, and admirably stood the severe tests to which they were put. This steel was put to other tests, some of which were severe and unusual, all of which proved entirely satisfactory. The process was next applied to cinder-pig, without mixture with any other iron, and good, strong, tough merchantable bars were produced.

The next application of the process was made to a very ordinary North Staffordshire pig-iron, also costing about 3*l.* per ton at the works. Three furnaces were charged with this iron, and were kept running for several days, each heat being treated by the "SHERMAN process." Each heat was taken from the furnaces in less than an hour, and all were rolled into good, strong, tough puddled bars, equal to any made from best English pig. Some of these bars were re-heated, and re-worked into bar-iron 1¼ in. square. Pieces cut from these bars were bent cold to an angle of 180° without any indication of fracture, and after being nicked on one side they would bend to the same angle, the slight break at the point nicked showing a clean, tough, silvery fibre. This iron was pronounced at the works, and by other judges, to be at least equal to what is termed "*best best*" charcoal iron. Several tons of this iron will in a few days be melted, and by the application of the "SHERMAN process" be made into cast-steel. The gentleman to whom we are indebted for this communication was a witness to many of the trials above stated, and all the statements which relate to proceedings at the Darlaston Works will, in connection with other facts of the same nature, be verified by Mr. M. E. T. MAINWARING, the manager of those works; and also, it is presumed, by the managing director there. Many other interesting facts in regard to steel made by the "SHERMAN process" from common, or a poor quality of English iron, such as the manufacture of files, dies, &c., might be given, but the above will suffice to enable an estimate of the value of the process to be formed.

THE INSTITUTION OF CIVIL ENGINEERS.

PREMIUMS—SESSION 1869-70.

The Council of the Institution of Civil Engineers have awarded the following Premiums:—

A Telford Medal, and a Telford Premium, in Books, to EDWD. DOBSON, Assoc. Inst. C.E., for his paper "On the Public Works of the Province of Canterbury, New Zealand."

A Watt Medal, and a Telford Premium, in Books, to R. PRICE WILLIAMS, M. Inst. C.E., for his paper "On the Maintenance and Renewal of Railway Rolling Stock."—[Has previously received a Telford Medal.]

A Watt Medal, and a Telford Premium, in Books, to JOHN THORNHILL HARRISON, M. Inst. C.E., for his paper "On the Statistics of Railway Income and Expenditure, and their Bearing on Future Railway Policy and Management."—[Has previously received a Telford Medal.]

A Telford Medal, and a Telford Premium, in Books, to THOMAS SOPWITH, Jun., M. Inst. C.E., for his paper "On the Dressing of Lead Ores."

A Telford Medal, and a Telford Premium, in Books, to JAMES NICHOLAS DOUGLASS, M. Inst. C.E., for his paper "On the Wolf Rock Lighthouse."

A Watt Medal, and a Telford Premium, in Books, to GEORGE BERKLEY, M. Inst. C.E., for his "Observations on the Strength of Iron and Steel, and on the Design of Parts of Structures which consist of those Materials."

A Watt Medal, and a Telford Premium, in Books (to consist of the Second Series of the Minutes of Proceedings, vols. xxi. to xxx. inclusive), to ROBERT BRIGGS, of Philadelphia, U.S., for his paper "On the Conditions and the Limits which Govern the Proportions of Rotary Fans."

A Watt Medal, and a Telford Premium, in Books, to EDWD. ALFRED COWPER, M. Inst. C.E., for his paper "On Recent Improvements in Regenerative Hot-Blast Stoves for Blast Furnaces."

A Telford Premium, in Books, to JOHN GRANTHAM, M. Inst. C.E., for his paper "On Ocean Steam Navigation, with a View to its Further Development."

A Telford Premium, in Books, to DANIEL MAKINSON FOX, M. Inst. C.E., for his "Description of the Line and Works of the Sao Paulo Railway in the Empire of Brazil."

The Manby Premium, in Books, to EMERSON BAINBRIDGE, Stud. Inst. C.E., for his paper "On Coal Mining in Deep Workings."

The Council have likewise awarded the following Prizes to Students of the Institution:—

A Miller Prize to ROBERT WILLIAM PEREGRINE BIRCH, Stud. Inst. C.E., for his paper "On the Disposal of Sewage."

A Miller Prize to HENRY THOMAS MUNDAY, Stud. Inst. C.E., for his paper "On the Present and the Future of Civil Engineering."

A Miller Prize to WILLAM WALTON WILLIAMS, Jun., Stud. Inst. C.E., for his paper "On Roads and Steam-Rollers."

A Miller Prize to SIDNEY PRESTON, Stud. Inst. C.E., for his paper "On the Manufacture and the Uses of Portland Cement."

A Miller Prize to EDWARD BAZALGETTE, Stud. Inst. C.E., for his paper "On Underpinning and Making Good the Foundations of the Irongate Steam Wharf, St. Katherine's, London."

A Miller Prize to JOSIAH HARDING, Stud. Inst. C.E., for his paper "On the Widening of the Liverpool and Manchester Railway between Liverpool and Huyton, and on the Construction of a Branch Line to St. Helen's."

A Miller Prize to the Hon. PHILIP JAMES STANHOPE, Stud. Inst. C.E., for his paper "On the Metropolitan District Railway."

The list of Members of this Institution, corrected to Oct. 1, has just been issued. At that date there were on the books 16 Honorary Members, 699 Members, 994 Associates, and 176 Students—making a total of 1885 of all classes. During the last three months the deaths have been recorded of three members—Messrs. John Braithwaite, Samuel Alison, and William Alexander Provis, as well as of five Associates—Sir John Thwaites, Bart., Lieut.-Col. Julian, St. John Hovendon, R.E., and Messrs. William Gammon, George Houghton, and George Barnard Townsend; while one Student has been permitted to retire. In the period referred to no addition has been made in the list.

FURNACES.—The invention of Messrs. R. BLAKEBOROUGH and S. SANDERSON, Huddersfield, consists in forming a passage or passages along the bottom or other part of the ashes place by preference of metal, and of considerable extent of surface towards the grate bars. This passage or these passages is or are connected into the back part of a hollow bridge or chamber constructed of metal or other material at the back part of the furnace, which bridge or chamber is divided by a vertical mid feather extending to near the top thereof and crosswise of the furnace, and to the front part of the chamber is connected one, two, or more metallic pipes, which are arranged immediately under the grate bars, forming a continuation of the passage or passages extending to the front of the ashes place.

TREATING ORES.—Messrs. G. HOLCROFT and R. M. ROBERTS, Manchester, having sorted the ores in their respective kinds, calcine each sort separately, according to the length of time required to extract the foreign matter it may contain, and whilst hot they immerse the ore in a solution prepared for each kind. These solutions contain the ingredients hereinafter named, and are prepared in the following manner:—First, for the ore containing talurian bismuth, the inventors immerse the ore for about seven days in a solution of common salt and muriatic acid, or their equivalents. In preparing this solution of oplate upon a ton of ore they take 4 cubic feet of soft water, to which are added 2 lbs. of common salt and 1 lb. of rectified muriatic acid of about 28° of Twaddel's hydrometer. Secondly, for the ore containing arsenic the inventors immerse for about 48 hours in a solution of saltpetre and sulphuric acid, or their equivalents. In preparing this solution for operating upon a ton of ore they take 4 cubic feet of soft water, to which are added 1 lb. of saltpetre and ¼ lb. of rectified sulphuric acid of about 28° Twaddel.

FOREIGN MINING AND METALLURGY.

It will be a matter of some interest to the iron trade to learn that the Brazilian Government is about to make some rather important additions to its iron-clads. The additions will comprise some rather large vessels, and two of these are to be built in England. The credit of Brazil being good, this order, which is looming in the not very remote distance, must be regarded as a very desirable affair.

The Belgian coal trade has not improved. So far, indeed, from any amelioration in affairs being possible, under present circumstances, it is even probable that the few remaining localities in France to which it was still possible to forward coal will soon be closed, so that it will become more than ever necessary to increase the stocks in warehouse. All parties, employers and employed, will necessarily suffer from this unfortunate state of things. There is a tolerably good demand for coal on domestic account, and this circumstance somewhat mitigates the position in which the Belgian coal trade is for the present placed. Belgian metallurgical works have still a certain amount of employment, and, as their owners appear disposed to submit for the present to very low profits, it is hoped that they may be kept going.

It is not surprising that in the present state of France metallurgical advices from thence should again entirely make default.

The Belgian Department of Public Works has now definitively given out orders for 19,186 tons of rails of the Vignoles type, rolled by the ordinary process, with fish-plates. The orders were shared as follows among the Belgian works:—Couillet Company, 3390 tons; De Dorlodot Frères, 3390 tons; MM. Blondeaux and Co., 2404½ tons; the Montigny-sur-Sambre Works, 2404½ tons; the John Cockerill Company, 2292½ tons; the Monceau-sur-Sambre Works Company, 1673 tons; the Zone Works Company, 805½ tons; and M. Bocqueau, 595 tons. The principal Belgian construction workshops are still well provided with orders; nevertheless, it would be very desirable if new orders were proposed to them without delay, in order to avoid any interruption in affairs during the winter. The great Belgian firms—the Cockerill Company, of Seraing, the Railway Plant Company, of Brussels, the St. Leonard Company, of Liége, and the Couillet Company—are stated to be disposed to supply the Belgian State Railways next year with 30 locomotives, for 60,000*l.*; no definitive contract has yet, however, been signed.

The continental copper markets have not presented much change. At Havre, Chilian in bars has brought 64*l.* per ton; refined ditto, in ingots, 73*l.* to 74*l.* per ton; Peruvian minerals (pure standard), 70*l.* to 70*l.* 10s. per ton; United States (Baltimore), 76*l.* to 78*l.*; ditto Lake Superior, 80*l.* to 86*l.*; ditto Mexican and Plata, in bars, 66*l.* to 68*l.* per ton. At Marseilles the quotation for Toka for consumption is 76*l.* per ton; for Spanish, 68*l.*; for refined Chilian and Peruvian, 76*l.* per ton. The tin markets have been quiet. In Holland Banca tin remains offered at the prices of the recent public sale of the Dutch Society of Commerce; as regards Billiton there have been scarcely any lots upon the market. At Rotterdam, Banca has made 75½ fls., and Billiton 74½ fls. per ton; at Amsterdam similar quotations have been current. At Marseilles lead in saumons, first fusion, for consumption, has brought 18*l.* 4s. per ton; second fusion ditto, 17*l.* per ton; argentiferous ditto, 17*l.* 18s. per ton; lead in shot, 20*l.* per ton; rolled and in pipes, 20*l.* 16s. per ton. At Amsterdam, Stolberg has been quoted at 11 fls.; and miscellaneous marks at 10¾ fls. In zinc there has been little change.

In Germany metallurgical industry is reported to be in a tolerably satisfactory state. The principal difficulty experienced arises from the want of means of transport.

There is a great demand at Liége for revolvers. The business doing in fire-arms generally is also very considerable.

It is understood that the Belgian Government proposes to give out an order for trucks and carriages for the Belgian State Railways. The principal Belgian firms devoting themselves to the manufacture of railway plant have decided on accepting orders at cost price, with the object of employing their numerous workmen. They have appointed three delegates to come to an understanding with the Government as to the conditions upon which the contemplated contracts are to be accepted. The amount of the orders given out will not exceed for the present 40,000*l.*

FOREIGN MINES.

ST. JOHN DEL REY MINING COMPANY (Limited).—Advices received September 29, *via* Bordeaux, ex steamer Sindh.

Morro Velho, August 29.—GENERAL OPERATIONS.—Our general work during the past fortnight has gone on steadily, and moderately good duty has been performed both in the mining operations and also at the extensive surface works now in hand. The weather continues favourable, and a full force of miners and labourers has been regularly at work at their respective localities.

The produce from the mineral stamped during the second division of this month, being a period of 13 days, amounts to 4172 oits. It has been derived as follows—viz.,

	Oitavas.		Tons of stone.	Oits. p. ton.
From General mineral	2496	from	988·6	= 2·524
From Gamba ditto	1073·5	,,	454·5	= 2·361
From Cachoeira ditto	602·6	,,	306·7	= 1·964
Total	4172·1	,,	1749·8	= 2·384

The above is the best gold return we have had for some time from the mines, chiefly owing to the increased supply of mineral we have had from the western part of the Gamba Mine, as brought to surface by the new inclined plane recently constructed therein. The general health of the establishment continues to be satisfactory.

Advices received Oct. 5, ex steamer *via* Liverpool:—

Morro Velho, Sept. 1.—SINKING SHAFTS: I beg leave now to advise you of the sinking effected during the month of August:—

	Fms.	ft.	in.		Fms.	ft.	in.
A shaft has been sunk	4	0	4	Total depth....	79	2	0
B shaft has been sunk	3	4	6	,, ,, ...	77	0	10
Total sinking in the month	7	4	10				

The above shows the sinking nearly 2 fms. less than was accomplished in July. The rock has been hard and tough part of the month in A, and lately there has been an increase of water in B shaft, which has impeded the sinking.

Advices received Oct. 18, ex steamer Oneida, *via* Southampton.

Morro Velho, Sept. 17.—GENERAL OPERATIONS: During the past two weeks the general work, both at surface and in the mines, has been carried on with regularity, and a fair amount of duty has been accomplished. The weather has been favourable, our greatest drawback having been the continued decrease of the supply of water.

PRODUCE.—The gold extracted for the month of August has amounted to 10,133·3 oits. It has been derived as follows:—

	Oitavas.		Tons of stone.	Oits. p. ton.
From General mineral	5678·5	from	2298·3	= 2·470
,, Gamba ditto	2245·4	,,	1082·7	= 2·073
,, Cachoeira ditto	1402·4	,,	715·8	= 1·959
Total stamps' produce	9326·3	,,	4096·8	= 2·276
From Arrastres	579·3			= 0·141
Praia ditto	227·7			= 0·056
Total produce	10,133·3		4096·8	2·473

The quantity of mineral reduced is about 70 tons less than was stamped in July, and the produce is 1455 oitavas more. The improvements having been chiefly in the higher gold recovery from the mineral treated in the general stamps, the standard yield having been 2·473 oits., as compared with 2·082 oits. extracted in July. The increased quantity of mineral obtained from the western part of the Gamba Mine by the new inclined plane has aided in producing the improvement.

COST AND LOSS.

		£	s.	d.
The gold return being	10,133·3 oits.			
Deduct loss in melting	20·0			
Total	10,113·3, at 7s. 9d. per oit.	£3918	18	0
Cost—Labour .... Rs. 27,750 $951				
Other charges .... Rs. 20,584 $028				
Rs. 48,334 $979, at exchange 22¾d. per milrei		4581	15	1
Loss on working for August		£662	17	1

FERNAM PAES ESTATE.

Outlay at Gaia Level Rs. 480 $360, at 22¾d. per milrei .... £ 45 10 8

NEW SHAFTS AND SURFACE WORKS.

The expenditure for August has been Rs. 16,639 $ 300, at 22¾d. £1577 5 4

The Morro Velho cost for August is as nearly as could be expected the same as was incurred in Milreis in July, but the exchange is a ½d. against the month of August. Some prices have been above the average, but the cost, on the whole, is just about what has been incurred for several months past. The outlay for new shafts and surface works, owing to the increased quantity of timber consumed, is a little heavier than during some previous months.

MINES.—We have not had quite so large an average attendance of natives in August as during July. The following shows the daily average attendance in the mine department:—

Natives boring daily	114·37	Natives working daily	243·48
Others ditto	3·8	Others ditto	216·33
Total	117·55	Total	459·81

Being 22·20 less than the average attendance in July.

The stone hauled and delivered at surface during the month amounts to 5454 mine wagons, and gives a duty of 36·95 wagons per borer employed.

In the GAMBA MINE the sump has been sunk 3 feet vertically, and the level towards the Cachoeira has been driven 7 feet. One shaft piece has been put in for the extension of the shaft, and five pieces for securing ground. The stoping has been carried on steadily, and a fair force kept employed in the western stopes.

In the CACHOEIRA MINE the stoping has been carried on in the same parts of the east and west sections, and about the same quantity of stone raised. That obtained from the western part has been of inferior quality. At the eastern section the lode continues about the same in size and auriferous quality.

BAHU.—A very small amount of mineral has been quarried from the upper stull, No. 1, in this mine. The pump has just kept the water under control, not gaining much on its level.

The GENERAL WORK in the department has been carried on with regularity.

NEW SHAFTS SINKING.—The sinking effected during the first 15 days of September, as shown by the measurements made yesterday, is as follows:—

A shaft has been sunk .... 1 fm. 4 ft. 0 in.
B shaft has been sunk .... 1 fm. 4 ft. 6 in.=3 fms. 2 ft. 6 in.

Being at the rate of 3½ fms. per month.

The sump A has been hard, having also veins, and being very tedious to bore and blast. In B an increased quantity of water was cut on Aug. 31, which has greatly impeded the blasting of the holes, owing to the quickness of the water therein. A kibble with the contents of 130 gallons has been provided and put to work in this shaft, with the view of keeping the water more effectively under control.

SURFACE WORKS.—The new water-course from the cistern at the Bon Virta ravine pipes to the roadway below the Futa mill, being a length of 683 ft., has been completed, and is now ready to receive and convey the Critaes water whenever the change can be conveniently made from the old water-course. The whole length of the water-course from the Critaes ravine will be cleared out when the water is turned off to connect the cistern with the new water-course.

PUMPING-WHEEL FOR NEW SHAFTS.—It may be satisfactory to know that this wheel, of 50 ft. diameter, is now completed, and the greater part of the pump-rods are in hand, and being prepared rapidly.

NEW SERIES OF LAUNDERS.—103 ft. lineally of these launders are now erected on the level of the new water-course, above the old line, and there are planks prepared for about 300 ft., ready for putting together. The whole length of this series, from Bow Vista to the Powder Magazine Bridge, Salvador, is 526 ft. The launders are 4 ft. wide and 2 ft. deep, and, therefore, consume a large quantity of log-timber. The work is being executed strongly and well, with first-class quality of timber. The erection of these launders does not interfere with the supply or conveyance of the water through the old ones to the hauling-wheels and reduction-works.

REDUCTION DEPARTMENT.—The diminished supply of water has not admitted of nearly average duty being done in this department. The following shows the machinery employed and the results thereof:—

Stamps working with 126 heads, average	27·60 days.
Ditto for the month, average	112·18 heads.
Arrastres each has worked	21·15 days.
Produce of each stamp head per diem	2·682 oits.
Produce of each arrastre	1·714 oits.
Produce of arrastre on that of stamps	6·21 per cent.

The mineral reduced amounted to 4096 tons, and the sand amalgamated 3952 cubic feet, which yielded 2·45 oits. per cubic foot. The unrecovered gold contents, 1·638 oits. per ton. The supply of stone from the mines has been ample for the stamps' consumption, and the spalling has been conveniently and rather easily effected, from having a little stock daily on the floors. Experiments are being continued by the reduction officer for the better recovery of the gold contents of the mineral, but as yet they have not been applied on a scale large enough to admit of a conclusion being arrived at as to their suitability for the accomplishment of the end in view.

GOLD EXTRACTED TO DATE.—The produce from the mineral treated in the stamps during the first division of September, being a period of 11 days, amounted to 2879 oits. It has been derived as follows:—

	Oitavas.		Tons.	Oits. p. ton.
From General mineral	1853·8	from	745·0	= 2·488
,, Gamba ditto	583·8	,,	363·5	= 1·606
,, Cachoeira ditto	441·8	,,	250·1	= 1·766
Total stamps	2879·4	,,	1358·6	= 2·119

This is not quite so good produce as was extracted in some of the divisions the previous month. The mineral from the West Cachoeira has not been quite so good, nor has that drawn from the eastern part of the Gamba Mine.

The health of the establishment continues satisfactory.

DON PEDRO.—Mr. F. S. Symons reports—Produce for August, 7672 oitavas; profit, 336*l.* The works have been carried on with regularity, and I am pleased to report that the produce exceeds that for July by 811 oitavas. The horse-engine has been superseded, and pumping machinery attached to the new 30-feet wheel, which was put to work on the 31st, and answers admirably.—First Division of September, Extract from Letter, dated Sept. 17: Produce weighed to date, 1769 oitavas. The pumping machinery working admirably, and the sinking of Vivian's shaft has been resumed. The general work excavated has been of low standard; a very little box work, not rich, taken from line No. 6, which at present is poor and disordered. Nothing new at Alice's west. The ground wet and troublesome at middle adit; we have been obliged to increase the force of Englishmen there. At Treloar's fair progress is being made. A commencement has been made to sample corrego at Mato das Cobras.

TAQUARIL.—Capt. T. Treloar (Sept. 5) reports—When I inspected Taquaril Mine in June last I informed you that I had seen sufficient to prepare me for surprising results. Since then the bottom of the mine has been cleared out and examined, and ocular and tangible proof of its riches obtained, as gratifying as it is marvellous, and the company have now solid ground for expecting a brilliant future. All the mineral debris found lying in the mine is auriferous, and is stocked; the lodes where cut into are everywhere auriferous, and 6 tons taken from about the shoots and rudely treated yielded 185 ozs. of gold, or nearly 31 ozs. per ton. Now this result, be it remembered, is not like produce expected from assays, or produce expected from samples of a few pounds of ore, but it is the actual tangible gold obtained from 6 tons of stone, and as it came chiefly from the side of the old workings it may be fairly doubted whether even this return represented the value of the lode on the shoots. From some stone which I have broken myself, and which is now being roughly treated, I am inclined to think not.

ANGLO-BRAZILIAN.—Mr. F. S. Symons reports—Produce for August, 2541 oits.; loss, 427*l.* 12s. 9d.—General Remarks: The supply of water has been slack, consequently less stone has been stamped, and the quantity of gold under that for last month, but the standard is a trifle better.—First Division of September: Mine: No change to report; works proceeding in a regular manner. Attendance better than in the commencement of the month.

GENERAL BRAZILIAN.—Capt. T. Treloar reports for August—Our operations generally have progressed apace. The adits advancing favourably, force increasing, weather fine, and establishment healthy.—First Division of September: Our operations generally to date are progressing favourably, but nothing has occurred calling for special remark. We have had rain, and this will be beneficial to the pastures.

ROSSA GRANDE.—Mr. Ernest Hilcke reports—Produce for August, 1230 oits.—Report for August: The works have proceeded satisfactorily, and, considering the irregularity in native attendance, fair duty has been done.—First Division of September: The features of the lode at Mina da Serra are much the same. A small force has been set to work at the Coco lode. At the Cachoeira and Gongo Mine nothing new to note.

CUIABA (Gold).—Sept. 13: Vivian's Level: We have completed tramway to new shoot, 100 fms., and are now driving through the covering of the hanging wall of the Fronte Grande lode. At this point of intersection we shall have a lode of virgin ground westward of 440 fms., while to the south-east are the lodes of Gamba, Terra Vermelha, and Bahu, from which ore stone has been extracted, giving 320 ozs. to the ton.

BRAGANZA (Gold).—Capt. Roberts, Sept. 12: Deep adit has been driven during present month 6 fms. 2 ft. 2 in., total distance driven, 50 fms. 5 ft. We are now driving through the most auriferous stratum that I have yet seen in this adit, containing white mundic disseminated through it. B cross-cut, 170 ft. above deep adit, has been driven 10 fms. 2 ft. 6 in. We hope to cut lode No. 1 some time this month, as the ground is very favourable. In C cross-cut, or tram-road level, we have sunk the winze on the footwall of the lode, towards B cross-cut, 5 fms. 3 ft. This winze is for ventilation, and for affording facilities for transporting the ore to the stamping-mills. We have driven north, on the course of the lode (No. 1), 7 fathoms, through a massive auriferous lode; we have 4 fms. more to hole to the gully, where the lode, with its branches, is 15 ft. wide. Lode No. 2 has been uncovered north and south of the gully, for 6 fms. in height; the attle has been cleared away, so that we may commence stoping as soon as required; we cannot ascertain its size until we take it down. Our force, you will observe, is principally occupied in preparing for the ventilation of our works, and for the conveyance of the mineral to the stamping-mills, on the most economical principle. Good progress has been made in the erection of houses for Europeans and natives. Timber is also being prepared for a larger wheel for the stamping-mill.

ECLIPSE (Gold).—Capt. Barratt, Sept. 16: Since last I addressed you in reference to our progress we have finished cutting down main shaft, and it is now in order to receive the double truck (rails). The men are now engaged at surface cutting ground for track from shaft to the tip, or dump; this will also be finished to receive the rails in a few days. The railroads will be laid immediately, and permanent mining operations will be commenced as early as possible. The carpenters are engaged building whim; when it is finished and erected on the main shaft there will be nothing to delay our future mining operations.—Stamps: The boiler and fittings have arrived, and the English machinery (engine, stamps, &c.) will be here in a few days. We have had a great amount of preliminary work to do at the mine, which took us considerable time, but that being nearly got through established mining will soon be commenced, and I calculate our mill will be in full operation by Christmas next, when we shall be returning gold, and I feel the produce will be very gratifying to all concerned.

COLORADO TERRIBLE LODE.—The company sold by public ticketing, in Liverpool, four lots, about 28½ tons of first-class ore, at prices averaging 127*l.* 16s. per ton. This quantity represents the first-class ore mined up to June 30 last. Further shipments are on the way.

EXCHEQUER.—Lewis Chalmers, Sept. 19: On the 17th the winze was down 83½ ft.; the cross-cut in the 100, from the north drift, was in 6 feet (8 ft. in all) and the air-shaft was up 100 ft. I have to-day commenced running north from the 80 (level 3), and have struck good ore. The assay-office, &c., is progressing, and all goes on well.

[For remainder of Foreign Mines see to-day's Journal.]

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending October 16 was 9473*l.* 13s. 4d.

TANGYE BROTHERS AND HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON,

CORNWALL WORKS (TANGYE BROTHERS), BIRMINGHAM

SOLE MAKERS OF

THE "SPECIAL" STEAM PUMPS.

Over 1000 in Use.

IN USE AT

The Black Boy Collieries, Bishop Auckland.

The Westminster Collieries, Wrexham.

The Monkwearmouth Colliery, Sunderland.

The South Benwell Colliery Newcastle-on-Tyne.

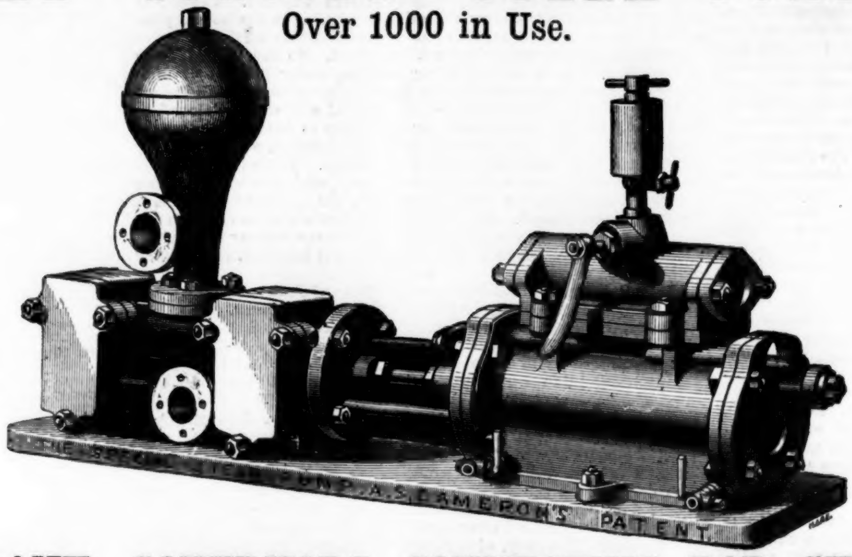
Messrs. Bagnall and Sons' Colliery, South Staffordshire.

Acomb Colliery, Hexham.

North Bitchburn Colliery, Durham.

Brancepeth Colliery, Durham, &c., &c.

And numerous others.



NOTE.

Requires NO Shafting, Gearing, Riggers, or Belts.

All Double-Acting.

Works at any Speed, and any Pressure of Steam.

Will Force to any Height.

Delivers a constant stream.

Can be placed any distance away from a Boiler.

Occupies little space.

Simple, Durable, Economical.

NO FLY-WHEEL, CRANK, GOVERNORS, CONNECTING ROD, GUIDE, OR ECCENTRIC.

Supplied to H.M.'s Arsenal and Dockyards at Woolwich, Chatham, and Devonport, also for use on board H.M.'s Ships, Hercules and Monarch.

FORTY THOUSAND GALLONS PER HOUR IS BEING RAISED 40 FEET HIGH AT MR. MCMURRAY'S PAPER MILL , WANDSWORTH, BY THE "SPECIAL" STEAM PUMP.

THE "SPECIAL" STEAM PUMP AS APPLIED TO DRAINING QUARRIES.

The engraving illustrates the "SPECIAL" Steam Pump as employed in draining quarries. At the Bangor and Carnarvon Slate Company's Quarries, in Wales, four or five of these pumps, of different dimensions, are at work, as well as at other quarries in various parts of the kingdom.

The pump being fixed in the required position, steam can be supplied by means of a felted steam-pipe from any boiler situated several hundred feet away from the pump; and although a little extra condensation would in such case take place, this system

of draining quarries is found far more economical than employing detached engines and pumps, with their cumbrous details of shafting, gearing, riggers, and belts.

The "SPECIAL" Steam Pump can be adapted to work at either high or low pressure steam, and to discharge the water to a vertical height of from 200 to 400 feet. For very high lifts, pumps with long strokes are recommended.

The pump is very portable, and can be readily lowered nearer to the water as the work proceeds.

THE "SPECIAL" STEAM PUMP AS APPLIED FOR DRAINING MINES.

One "SPECIAL" Steam Pump now making to force 1040 feet in one direct lift.

The arrangement in the accompanying illustration shows an economical method of draining mines without the expense of erecting surface-engines, fixing pump-rods, or other gearing. A boiler adjacent to the pit's mouth is all that is necessary on the surface; from thence steam may readily be taken down, by means of a felted steam-pipe, to connect the pump with the boiler. The pump may be placed in any situation that may be convenient for working it, and connecting the steam, suction, and delivery pipes.

These engines can be fixed and set to work in a

comparatively short time, and also at a very small outlay. They are used in large mines as auxiliary engines, and will be found invaluable adjuncts in all mining operations.

To estimate the quantity of water to be raised by any given size of pump refer to the tabulated list below. It is recommended to use long-stroke pumps where the height exceeds 100 ft., so that the largest result may be obtained with a minimum wear and tear of the pump pistons and valves. The pumps are provided with doors for ready acce s to all working parts.

PRICES OF THE 'SPECIAL" STEAM PUMPS.

Diameter of Steam Cylinder ....inches	2¼	3	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12	12	14	16	24
Diameter of Water Cylinder ....inches	1¼	1½	2	4	3	4	6	5	6	7	4	6	7	8	6	7	8	10	12	7	10
Length of Stroke ....inches	6	9	9	12	12	12	12	12	12	12	12	12	12	12	12	12	18	24	24	24	24
Strokes per minute	100	100	75	50	50	50	50	50	50	50	50	50	50	50	50	50	35	—	—	—	—
Gallons per hour	310	680	910	3250	1830	3250	7330	5070	7330	9750	3250	7330	9500	13,000	7330	9500	13,000	—	—	—	—
PRICE..	£10	£15	£20	£35	£30	£40	£47 10	£50	£52 10	£57 10	£50	£55	£65	£75	£70	£80	£100	—	—	—	—

IF BRASS LINED, OR SOLID BRASS OR GUN-METAL WATER CYLINDERS, WITH COPPER AIR VESSELS, EXTRA, ACCORDING TO SIZE.

Any Combination can be made between the Steam and Water Cylinders, provided the Lengths of Stroke are the same, thus—8 in. Steam and 3 in. Water, or 10 in. Steam and 3 in. Water, adapted to height of lift and pressure of steam, and so on.

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